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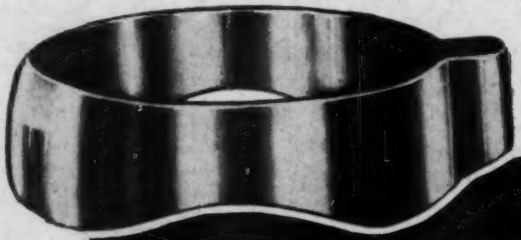

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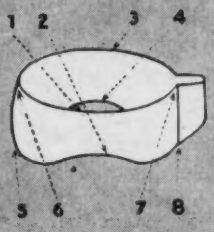

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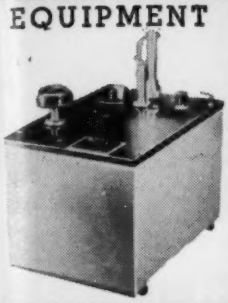

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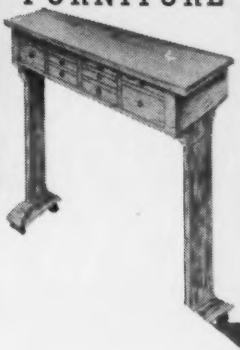

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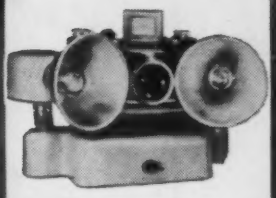

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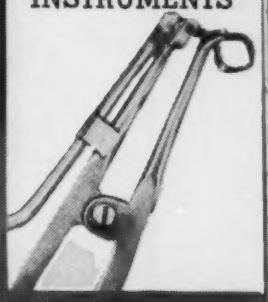

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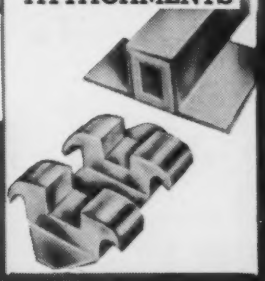

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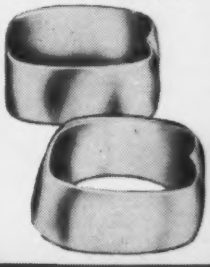

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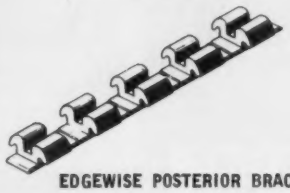

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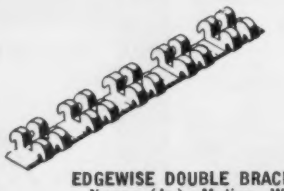

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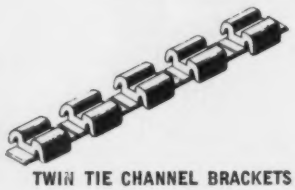

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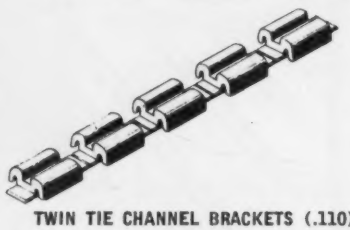

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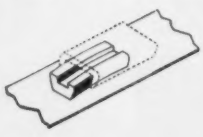

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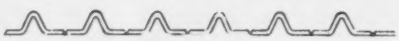

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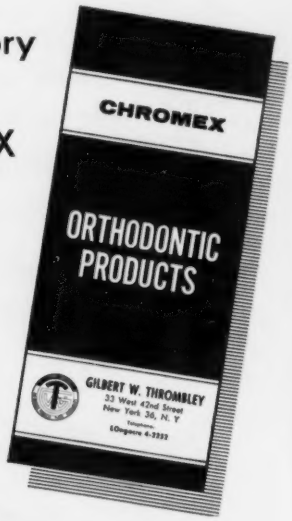

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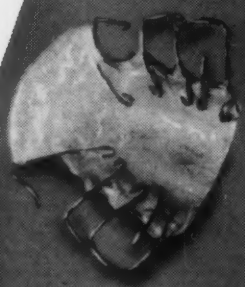

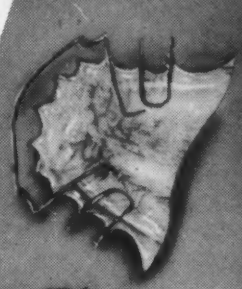

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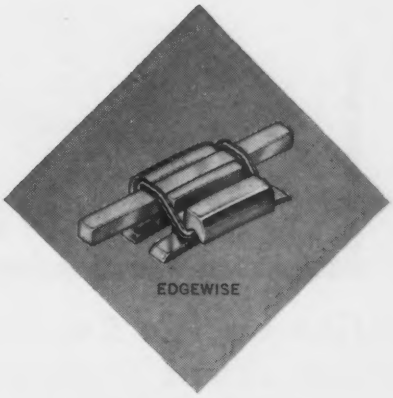

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The Management of ORAL DISEASE

A Treatise on the Recognition, Identification, and Treatment of Diseases of the Oral Regions

by

JOSEPH L. BERNIER, D.D.S., M.S., F.D.A., R.C.S. (Eng.) Colonel, Dental Corps, United States Army; Chief, Oral Pathology Branch, Armed Forces Institute of Pathology; Pathologist to the Registry of Oral Pathology of the American Dental Association; Professor of Oral Pathology, Georgetown University of Dentistry.

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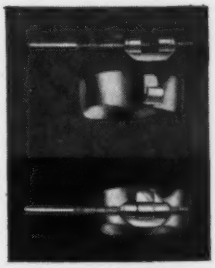

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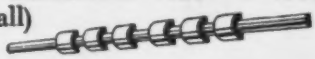

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By

PROFESSOR KARL HAUPL, M.D. (Innsbruck), Professor of Dental Surgery, University Dental School, Innsbruck.

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536 Illustrations on 309 Figures. 408 pages.

In this textbook on Functional Jaw Orthopaedics the authors have endeavored to present an up-to-date view of the theoretical basis and the practical aspects of functional orthodontic therapy. The latter aims at bringing about, as far as is possible, the necessary tissue changes by means of functional stimulation. In addition the book covers the use of active removal appliances such as were developed by A. M. Schwarz.

The authors purposely omitted a discussion of treatment with the help of active fixed appliances as this has been dealt with in a number of recent textbooks on orthodontics; in any case, it lies outside the scope of this book.

In the chapter on Aetiology and Diagnosis the authors have tried to survey the views held by all those dental schools which have been primarily responsible for the development of the removable appliance.

Certain methods of diagnostic investigation, of which profile X-ray is an example, could only be dealt with in outline. Views on their value as an aid in prognosis are still too controversial to be included in a book the prime concern of which is the practical use and scope of the active and removable orthodontic appliance.

A chapter has been included on orthodontic surgery.

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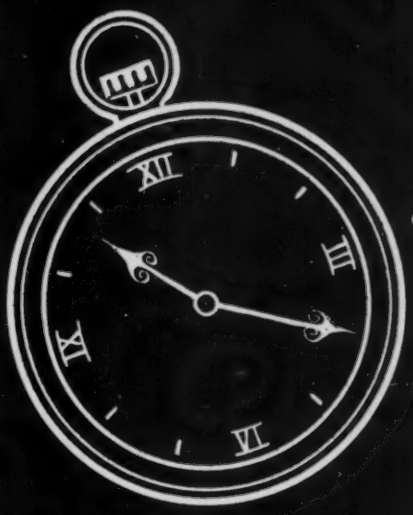

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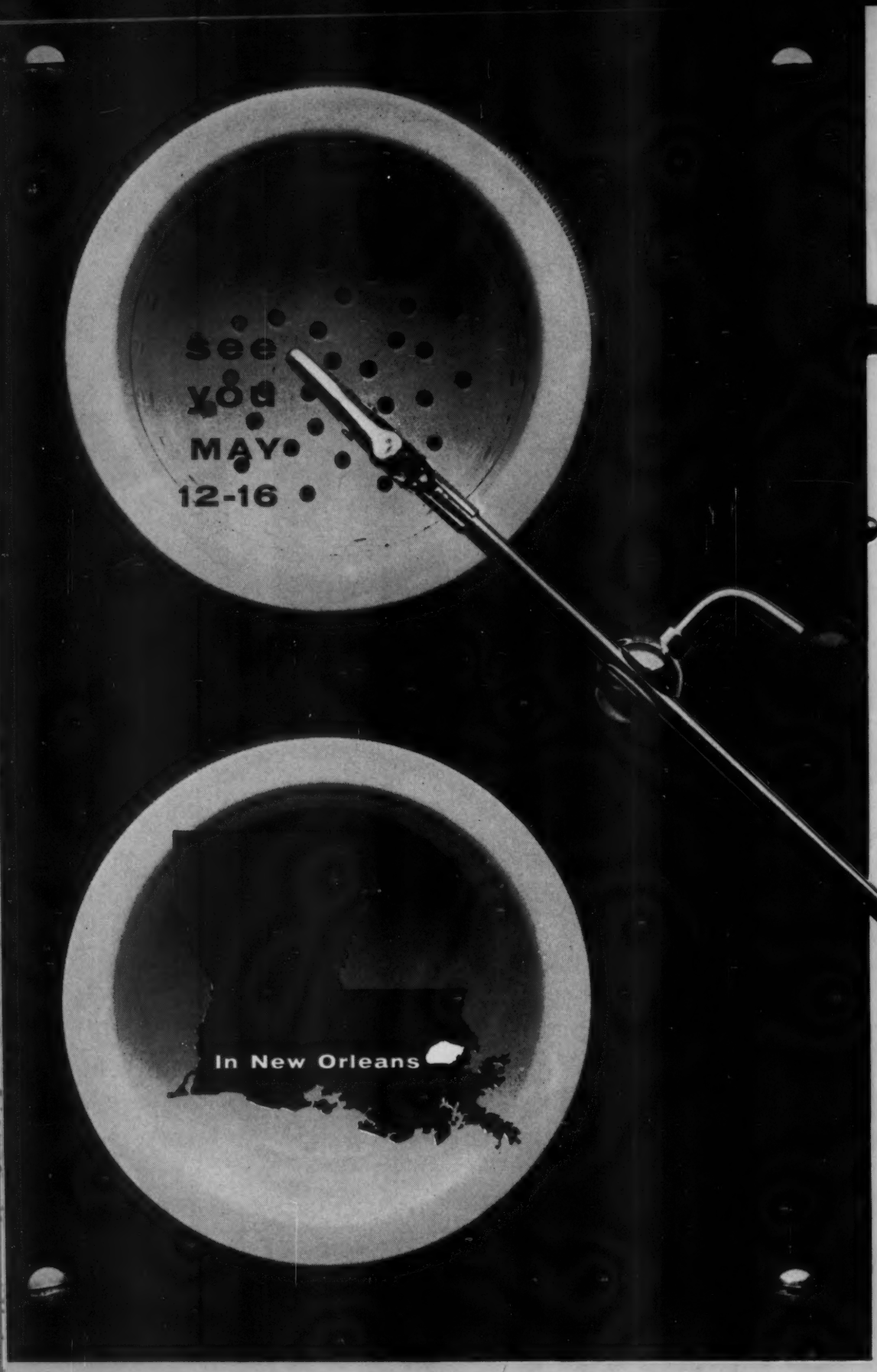

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Original Articles

ETHICS OF PATIENT TRANSFERRALS

SCOTT T. HOLMES, D.D.S., M.S., MUSKEGON, MICH.

AT THE 1955 meeting of the American Association of Orthodontists, the president was authorized to appoint a committee to study the matter of improving methods whereby patients may be transferred from one orthodontist to another. This committee was formed; the problem was studied diligently for approximately one year; and then the committee reported back to the American Association of Orthodontists at the 1956 annual meeting in Boston.

One of the recommendations of the national committee was that this matter be re-emphasized from time to time at the component society level, in a manner to be determined by the component society Committee on Patient Transferrals. The Great Lakes Society's Committee on Transferrals, under the chairmanship of Dr. Fisk, has recommended that time be set aside in this year's program for the analysis and discussion of this important phase of our professional life. The subject assigned to me by the Program Committee is a general one, namely, "The Ethics of Patient Transferrals."

I feel that it is a privilege and a pleasure to contribute to this program of our own Society, largely because of the sincere enthusiasm of our membership. In presenting this rather ticklish subject, I shall try to be as fair and objective as I can, but if I do say something that differs with your opinions, I will welcome your constructive criticism. In accepting this assignment, I feel a bit as though I were sailing an uncharted sea. As I look back over the twenty-four years that I have attended Great Lakes Society meetings, I

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do not recall a single paper dealing directly with the subject of patient transferrals. Naturally, there have been a few informal discussions, and I presented the matter rather briefly in my president's address in 1953. However, as a society, we have never before considered this matter of great enough importance to assign specific program time to the subject.

Now the question naturally arises: "Why is it important today?" Why are we concerned about a problem we hardly knew existed twenty-five years ago? I believe that the answer lies in the prolific growth of our profession. Twenty-five years ago there just were not many orthodontic cases to be transferred; and when one did receive a transfer case from another orthodontist, he was so highly pleased and flattered that he practically laid everything else aside and gave the case his undivided attention. It was an honor that was not to be taken lightly!

Today the picture is different. In 1926, the American Association of Orthodontists had 250 members, and each orthodontist carried relatively few cases as compared with present-day concepts. Today I do not know how many orthodontists there are in the country, nor do I have any idea how many active orthodontic cases there are, but I wager the number would astound all of us. We do know that all orthodontists are hard pressed to meet the demand for their services. The number of active orthodontic cases is increasing tremendously. Not only are there more orthodontic patients today, but they, like the rest of our population, seem to be constantly on the move. Our industrial system demands many changes in location of families of its well-trained personnel, and these are the families that seem to have a high incidence of orthodontic cases. This creates an ever-increasing problem for the orthodontic profession, a problem which cannot be ignored. We who live in industrial and resort communities are well aware of the rapid increase in patient transferrals during recent years, and the number of transferrals will unquestionably increase. The handling of a goodly number of transfer cases might just as well be accepted as an integral part of a modern orthodontic practice, and be planned for accordingly. The way in which orthodontists service or ignore these transfer patients could well play a vital part in their future well-being.

New citizens in a community often become important members of the community family, and the first impressions which these people receive may be indelible reminders for future reference. In my own community, we have recently been favored by having three rather large organizations move into our area. In each instance, children of management families were undergoing active orthodontic treatment. The parents were quite concerned about their children's orthodontic welfare and one family had already had a bad experience in a previous move. These people are now firmly and happily established in our community, but the one family is still unhappy about the way in which a previous move was handled. We are all aware of the problems caused by faulty, thoughtless, or slipshod transferral procedures; fortunately, however, we are equally aware of the happy results of conscientious, thorough,

and thoughtful transferral technique. There are as many differences in transferral procedures as there are in appliance therapies and therein may lie one of our problems. Most orthodontists are willing to concede that variations in appliance therapy are inevitable and acceptable, but in the realm of patient transferrals it seems logical to assume that some semblance of uniformity could be mutually beneficial.

In a general way, I believe, all of us have a fairly clear concept of what constitutes a good case preparation for patient transferral, and all of us have also encountered situations which emphasize the things we should not do. At the risk of appearing somewhat negative in its approach, your national committee decided to find out, first of all, what seemed to be wrong with our present procedure. It then hoped to make recommendations for the correction of these faults. Accordingly, letters of inquiry were sent out to quite a number of representative orthodontists throughout the country and to the orthodontic departments of our dental schools, asking for constructive criticism and suggestions for improvements.

The following points represent the collective opinions of the most glaring faults in our present transferral procedures:

1. Inadequate case histories and treatment records. Regardless of one's concept of diagnosis and treatment methods, it does not seem too much to expect that there should be clear, legible records of all data pertinent to diagnosis and treatment. Actually, this is a legal responsibility. It is almost unbelievable how pitifully inadequate some transfer records really are.

2. Unfounded and braggadocio statements apparently made by some referring orthodontists concerning the great amount accomplished by their treatment and the small amount still remaining to be done.

3. Failure on the part of the referring orthodontist to correspond with the accepting orthodontist and to send him a complete record in advance of the actual move by the patient. If the referring orthodontist does not feel that he has time to send a complete report in advance, how can he expect someone else to be gracious to him and to his partially treated patient?

4. Failure on the part of the referring orthodontist to emphasize to the parents the possibility of subsequent appliance changes, and to prepare the parents for possible changes in financial arrangements. Most parents are very cooperative and understanding when they are pleasantly and adequately informed.

5. Failure on the part of the accepting orthodontist to cooperate enthusiastically. Transferred patients are not "castoffs" or "stepchildren." They have a perfect right to be treated courteously and adequately. They offer one of the greatest opportunities orthodontists have for proving the existence of professional ethics and for demonstrating professional courtesy.

6. Ill-advised and sometimes unjust criticism of the first orthodontist by the second operator. Criticism of another orthodontist is self-incriminating by virtue of the fact that it is criticism of orthodontics itself.

7. Unnecessary delay on the part of the accepting orthodontist in planning and executing treatment for his newly accepted patient. The sooner the patient is happily situated and integrated into the active treatment schedule, the better for all concerned.

8. The practice of starting cases when the orthodontist anticipates an early move on the part of the patient. Under these circumstances, it would be much better to defer starting treatment until after the move has been completed.

This critical analysis of our present faults clearly emphasizes one point: There is nothing wrong with orthodontic transferrals that cannot be cured by cooperative effort on the part of conscientious orthodontists. Of course you are busy, but so are all the rest of us. When one becomes so busy that he does not have time to treat other orthodontists with grace and courtesy, he is riding for a fall just as sure as the sun rises. It has been said many times, and it bears repeating: "The Golden Rule can cure all the ills of faulty transferrals in short order, if the rule is only applied."

The ethics of any group of society constitute the rules of conduct of that group. We, as orthodontists, choose to think of ourselves as proud members of an honored profession. It therefore behooves us to pay special attention to our rules of conduct, lest we jeopardize our position as a profession. The honor and the esteem which we outwardly display for each other could well be the basis for our own evaluation by the rest of society.

Now, what are we going to do about it? Even though all of us have a general idea of correct procedure in this matter of transferral and acceptance of orthodontic cases, your Great Lakes committee feels that a restatement of these responsibilities is in order at this time. Accordingly, I have prepared a list of the duties and responsibilities of the transferring and accepting orthodontists as outlined by your national committee. At the request of the Great Lakes committee, this list has been printed and is being distributed for your consideration and for your future reference.

In summing up this presentation, I wish to emphasize that none of these recommendations are new or revolutionary. They represent a restatement of facts that are known to all of us. The question remains: "Is this my responsibility?"

Transfer of Orthodontic Cases

DUTIES OF TRANSFERRING ORTHODONTIST

1. It is the duty of the transferring orthodontist to assist the patient in every way possible to obtain the services of a competent orthodontist in the new locality.

2. If possible, one should choose an orthodontist who uses essentially the same appliance therapy.

3. A letter should be written to the second orthodontist in advance, requesting that he accept the case and giving him the following data:

   (a) Complete case history, including x-ray pictures, casts, photographs, physical history, and other pertinent data.

   (b) Diagnosis and treatment plan, including description of appliance.

   (c) Record of all treatment therapy given up to date of transferral.

   (d) Financial agreement and original estimated time of treatment. (The present status of patient's account should be included.)

   (e) Any special features of the case should be described, such as patient's personality and degree of cooperation. Special treatment problems should be discussed and anything that might be of help to the new orthodontist should be included.

4. Before the patient leaves, the orthodontist should be sure that all appliances are in good order and that the mouth hygiene is excellent.

5. The patient and parent should be advised that the accepting orthodontist must have full authority to treat the case in the manner which he feels is best. The patient should be reminded that orthodontic therapy envisions continual appliance change throughout treatment and that the new orthodontist will probably make various appliance changes as the treatment progresses.

6. The parents should be informed that fee schedules are not completely uniform throughout the country and that it is reasonable to expect some possible change in fee arrangement.

7. No statements should be made as to the amount of time the new orthodontist will require for completion of the case.

8. The parents should be advised that all records have been forwarded to the new orthodontist and that the referring orthodontist will always be available for consultation.

9. An added courtesy would be to furnish the patient with a letter of introduction to the new orthodontist. This seems to give the patient a feeling of added security.

ACCEPTING ORTHODONTIST

1. The accepting orthodontist should write a letter of acceptance to the referring orthodontist. If he finds it impossible to accept the case, he should make every effort to assist in securing the service of a third orthodontist.

2. He should study the data transferred to him and discuss the case thoroughly with the parent at the earliest opportunity. If at all feasible, he should maintain approximately the same fee schedule as the original orthodontist. If major financial changes are necessary, these should be explained in a manner that will not constitute a reflection on the former orthodontist.

3. The new patient should be integrated into the treatment schedule as quickly as possible.

4. If major appliance changes are unavoidable, most orthodontists agree that these changes should be made gradually without too much comment.

5. Previous treatment should never be discredited. Most patients think well of previous treatment and do not like to have the original orthodontist criticized.

6. In receiving a transfer patient, it is well to find something complimentary about the case and discuss it with the patient. It makes for friendly relations.

7. The patient should be accepted wholeheartedly and enthusiastically or not at all. These patients are not second-hand "castoffs" and they deserve the same courtesies and meticulous service as all other patients.

DENTO-MAXILLO-FACIAL ORTHOPEDICS: ETIOLOGY AND PREVENTION

J. A. SALZMANN, D.D.S.

Director, American Board of Orthodontics, New York, U.S.A.

SUMMARY

ETIOLOGY. Contributions to the etiology of dento-maxillo-facial anomalies during the period under review can be discussed, from the standpoint of genetic, systemic, prenatal, postnatal environmental and local causes.

Etiologic factors may express themselves indirectly through general constitutional changes or directly on the dento-maxillo-facial area. They may affect structure or its form and function. The anomalies may be symmetrical or asymmetrical and of different degrees of severity.

Different etiologic factors may give rise to the same type or classification of malocclusion and, conversely, malocclusion of the same classification may be due in whole or in part to different, unrelated causes.

Favorable genetic influences lead to normal growth and development. When they are unfavorable, they may lead to abnormalities of the dento-maxillo-facial area. Environment is frequently the deciding factor in the extent of the manifestation of abnormalities of genetic origin. Although the genetic growth pattern tends to manifest itself during growth and development, it can nevertheless be favorably modified by present orthodontic methods. Congenital abnormalities may or may not be of genetic origin. They may be due to abnormal state of the pregnant mother or to deficiencies in the fetus. Body build presents a new classification of importance to the orthodontist in establishing etiology and in treatment planning.

Cephalometrics as a method of establishing the etiology of dento-maxillo-facial anomalies in individual cases cannot be used with a high degree of certainty until 'base-lines' are established for the respective mean measurements. Such base-lines must show unique association with specific types of dento-maxillo-facial anomalies, including malocclusion of the teeth.

Variations in the morphology, number, time and order of eruption of the teeth are important etiologic factors in the establishment of malocclusion. Maxillary midline diastemas are as a rule normal developmental phenomena due to the pre-eruptive position of the incisors and canines; they may also be indicative of malocclusion.

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Muscle function, especially the size and function of the tongue, is an important etiologic factor in malocclusion. Muscle balance determines the 'area of tolerance' within which teeth will remain after orthodontic treatment. Disease and nutritional disturbances play important roles in dento-maxillo-facial development. Deficiency or over-function of the endocrine glands is associated with disturbances in dental development, eruption and jaw growth, although no specific endocrinopathy is productive of a pathognomonic malocclusion.

PREVENTION. Recognition of etiologic factors is important in the prevention, interception and treatment of dento-maxillo-facial anomalies. Prevention is the basic approach to 'public health' orthodontic endeavor. As long as we do not possess definitive knowledge of the etiology of malocclusion, we are limited in instituting preventive measures. However, present knowledge is sufficient to prevent and intercept much of the existing malocclusion. Orthodontic principles and prevention are important in every phase of dental practice, whether it be filling teeth, restoration of lost teeth, space maintenance and removal of overlong retained deciduous teeth, or treatment of the soft tissues of the mouth. The dentist must possess knowledge of normal growth and development of the teeth, jaws and face, and their deviations in order to institute proper measures to obviate the development of malocclusion.

Examination of the young child must be made at periodic time intervals using diagnostic aids which lend themselves to comparative analysis of the individual child and not necessarily to arbitrary or 'average' standards. Eruption, migration, and physiologic readjustment of the teeth, oro-dental pressure habits, and increase in jaw size and in the tonicity of the masticatory and mimetic musculature must be given due consideration.

Thumbsucking is considered a normal activity in infancy and usually disappears about the second year of life. If persisted in later years it is a symptom of emotional disturbance. Treatment involves the pediatrician, psychiatrist, dentist, child and parents. Force is contra-indicated. Nailbiting and 'open-bite' swallowing are among the habits responsible for malocclusion. Parents should be encouraged to establish a kindly cooperative relationship rather than be asked to 'police' habit breaking with its engendered tensions.

Space maintenance is not the simple procedure as usually practised. The entire dentition and the developing occlusion must be taken into consideration.

* * *

ETIOLOGIC PRINCIPLES

Etiologic factors in orthodontics express themselves in the three dimensions of space over a period of time. We are dealing, therefore, with a four dimensional problem which has phylogenetic and ontogenetic aspects.

Schrödinger (1945) likens the chromosome fibre, the most essential part of the living cell, to an aperiodic crystal which exhibits infinite variation and is subject to the laws of biophysics. What is true of the cell unit also holds for the body as a whole including the face, teeth and jaws.

Clinical orthodontics is concerned with the prevention, interception and correction of anatomic and morphologic deviations from accepted norms. These norms are not as yet clearly established mainly because of the wide range of variation in human morphology.

Dento-maxillo-facial deviations may be concomitant with, pathognomonic of, or sequelae to local or general bodily disturbances which constitute the basic etiologic factors. These factors may manifest themselves at any time after fertilization of the ovum and may at times be of a subclinical nature, or they may no longer be evident when the patient is examined. They may also cause deviations which are incidental expressions of normal growth. It is questionable whether they ever act singly.

CLASSIFICATION

I. Prenatal Etiologic Factors:

(a) Genetic; (b) Differentiative; (c) Congenital

II. Postnatal Etiologic Factors:

(a) Developmental; (b) Functional; (c) Environmental.

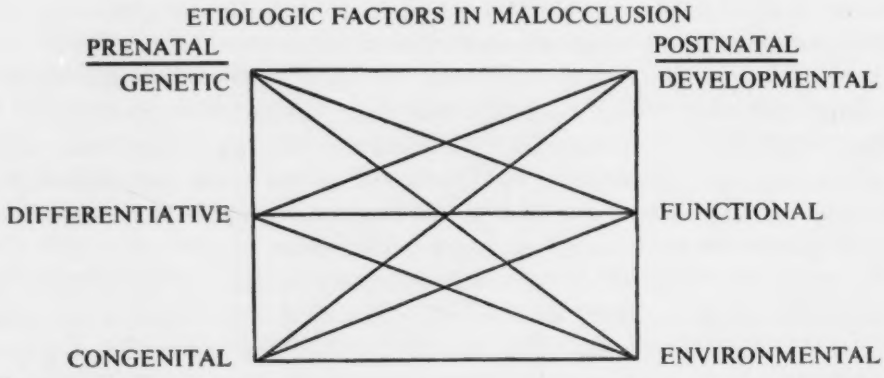

FIG. 1

Diagrammatic representation of the interdependence of the etiologic factors in malocclusion. From 'Principles of Orthodontics,' by J. A. Salzmann, Courtesy J. B. Lippincott Co., Philadelphia.

PRENATAL FACTORS

GENETIC. They may be familial or sporadic, may express themselves pre- or postnatally, and their severity varies. They are influenced by environment. Genetic factors may also establish in the individual a diathesis for certain diseases, habits or even traumatic injuries which can affect the dento-maxillo-facial area.

DIFFERENTIATIVE. Anomalies which are engrafted in the embryonic stage as when the organizer hormones are deficient, resulting in deviations of form, structure, and function. They are ontogenetic occurrences and are not necessarily of genetic origin.

CONGENITAL. Anomalies which are present at birth. They may be due to an abnormal state of the mother during pregnancy such as nutritional deficiencies,

endocrine disturbances, infectious diseases, age of the mother at conception, and trauma; or to disturbances of the fetus itself, such as osteoporosis and craniotabes; accidents of pregnancy and childbirth.

POSTNATAL FACTORS

DEVELOPMENTAL. Anomalies which manifest themselves during the active growth period may be due to general or local growth disturbances including malnutrition, endocrine, osteogenic and other diseases and trauma.

FUNCTIONAL. Since form and function are interrelated, disturbances in function act as etiologic factors in morphologic anomalies.

ENVIRONMENTAL. Anomalies caused by external factors to which the individual may be subjected and which interfere with the normal development and relationship of the teeth, jaws and facial outline.

ETIOLOGY 1951-1955

Genetics

Dobzhansky (1954) finds that the growth pattern possesses a genetically determined plasticity which makes it possible for environmental conditions to influence it. Strandskov and Washburn (1951) found positive evidence of genetic influence on variations in growth and development of the muscles, the nose, head-shape and teeth, as well as of other parts of the human body. Courtner (1953) and Haralabakis (1954) found positive familial resemblances in craniofacial dimensions as revealed by cephalostatic roentgenograms.

Wautier (1953) describes the manner in which genetic factors are responsible for the induction of dento-facial anomalies. De Coster (1955) discusses the manifestation of hereditary tendencies at different stages in the growth of the child. However, not all hereditary factors are unfavorable to dento-maxillo-facial development; in fact, quite the contrary is true. Postural maintenance of the head and face, especially of the mandible, and pressure habits may or may not have genetic connotations (Tulley, 1952).

Hatton (1955) found genetic endowment to play an important role in the rate and sequence of tooth eruption, although like all postnatal phenomena, this can be modified by environment. Hoffer (1954 a, b) warns that local etiologic factors which induce maldevelopment of the dental arches and malocclusion of the teeth may mask dominant hereditary etiologic factors in malocclusion.

Korkhaus (1952, 1954) discusses the effects of environmental factors on the modification of the hereditary growth pattern in monovular and biovular adult twins. Prognathism, deep-overbite and distoclusion with distal position of the body of the mandible as well as abnormal dental diastema he believes to be of genetic origin. Since function is an important growth factor it appears that organs used in vigorous function such as the muscles of mastication, the teeth and jaws are especially subject to environmental modification.

Hausser (1954) finds environment to be the deciding factor in the manifestation of anomalies of genetic origin and points out that early recognition, prevention, interception and treatment is a means for halting or modifying many types of malocclusion of genetic origin.

The importance of the genetic growth pattern is discussed by Goldstein (1953) who states that post-treatment evaluation of orthodontic patients shows a tendency of the occlusion to return to the original morphological pattern and to continue its activity after treatment is completed in younger children.

CONGENITAL

Murphy (1954) found that mothers averaged 23 years of age at birth of the first normal child. The first defective child was not born until the mothers averaged 28.4 years. Beginning at age 30, or even earlier, the proportion of defective children increased with each succeeding five-year period. When birth took place between 45 to 49 years the rate of abnormal children was 3 times that of mothers under 30 years of age.

Krugman and Ward (1954) confirmed the increased risk of congenital malformations, including cleft lip and palate, in children of mothers who had rubella during pregnancy. Hartman and Kennedy (1951) found no appreciable increase in the frequency of congenital anomalies among mothers who suffered illness during the first trimester of pregnancy. Ingalls (1953) observed the same malformations to be caused by wholly unrelated physical chemical and microbiologic agents.

Frazer and Fainstat (1951) state that in most instances congenital defects are caused by a genetically determined predisposition interacting with an environmental agent. Boder (1953) studied congenital facial asymmetry in 1,425 nonselected, full-term newborn infants. She established a relationship between facial asymmetry and congenital craniotabes and malocclusion due to pressure habits.

Facial hemiatrophy was reported by Rushton (1951) and Dechaume, Cauhépé and Dubruille (1954). The condition may be benign or pathologic and may show itself pre- or postnatally. They attribute it to involvement of the sympathetic nervous system.

Chatellier and Chateau (1955) reported a case of congenital absence of a mandibular condyle and attribute the condition to faulty development of the first branchial arch. The face on the unaffected side was normal while the affected side showed an extremely obtuse gonion angle. Jarabak (1954) reported on facial distortion following loss of a mandibular condyle by resorption after trauma due to a fall in a boy 3½ years of age, because of displacement of the fractured condyle which did not permit re-ossification.

Cleft Lip and Palate

The etiology of malocclusion in cleft palate is described by Kettle (1954) as being due to lack of balance between muscle function. In operated cleft palate cases the malocclusion may be due to faulty operation, scar tissue, interference with function or with the growth centres of the jaws.

Pruzansky (1955) described, classified, and analyzed clefts of the lip and palate. Harvold (1953) considers the major deformities in cleft lip and cleft palate not to be due to reduced growth potentials. He attributes the narrow dental arches to change in maxillary bone position and to inhibition of vertical alveolar growth.

Subtelny and Brodie (1954) call attention to the importance of the restraining influence on the alveolar process in cleft lip and cleft palate patients of the buccinator and superior constrictor pharyngeal muscular ring. The repaired musculature may bring about a narrowing of the palatal cleft and maxillary arch. Collapse of the arch before operation also occurs.

Anodontia and Oligodontia

Reitan (1953), Hutchinson (1953), and Cohen and Garn (1954) report on anodontia and oligodontia in association with ectodermal dysplasia, and in the absence of ectodermal and genetic association. Bouyssou (1953) reviewed the contributions on this subject including etiology, especially from the standpoint of genetics.

In oligodontia the condition is frequently symmetrical, and the teeth present may or may not be of normal shape. Supernumerary or atypical teeth may be present with failure of the normal dentition to develop the usual number of teeth.

Nanda (1954) found 9 per cent of 200 children to have agenesis of one or more third molars, of which 3 per cent showed also diminution in size of some third molars. Agenesis is more frequent in the maxillary arch, particularly on the right side. Third molars that were diminished in size were found only in association with agenesis of one or more of the third molars.

Sarnat, Brodie, and Kubacki (1954) studied a patient from 2 to 16 years of age, who had complete anodontia with ectodermal dysplasia. They found a slightly less-than-normal nasion-anterior nasal spine dimension, coupled with a markedly greater-than-normal vertical measurement within the nasal cavity proper. This gave the impression of a buckling of the palate.

POSTNATAL ENVIRONMENTAL

BODY BUILD

Lindegard (1953) verified Björk's findings to the effect that there is a positive relationship between the cranial base angle and prognathism. He found head length to be significantly correlated with all other head dimensions except bigonial breadth. The degree of alveolar prognathism of the upper jaw was proportional to that of the lower jaw. An individual with a large length factor and an average-sized sturdiness factor is characterized by flattened cranial base, high upper face and long mandible (as measured by the chin-condyle distance). A large sturdiness factor, but average-sized length factor, shows large brain case, large cranial base length and large face length. Size of the freeway space was found by Lindegard to be correlated with sagittal jaw relation and with the vertical extension of the total face.

A growth study of occlusion in relation to the 3 principal body types—brachy-type, hormonic-type and longi-type was reported by Barbara (1951). Gerlach (1952) found constitutional and hormonal factors to modify body type and to influence the manifestation of malocclusion.

Muzj, Maj and Lucchese (1954) and Maj, Lucchese and Miotti (1954) studied the correlation between the profile angle and the somatotype. They found a positive correlation between the angularity of the profile and the general constitution, especially in the longi-types (asthenic) which have a more receding facial profile than the brachy-types. Adorni-Braccese and Luzj (1954) confirmed the findings of the Italian school.

Hoffer (1954 a, b) points out that there is a connection between characteristic morphologic variations in the maxilla, palate, tooth development and arrangement, and constitutional stigmata. He found the somatotypes to be related to certain morphological variations of the masticatory apparatus. This is especially so in overbite and openbite.

Björk (1955 a) disclosed a positive correlation between ectomorphy (slenderness) and tooth crowding, while tooth spacing showed a positive correlation with mesomorphy (sturdiness). He found no correlation between dental arch shape and body build. Tooth size and the size of the dental arches, but not tooth spacing, were found by Björk to vary with skeletal sturdiness and length. Skeletal sturdiness shows a tendency to buccal occlusion while slenderness was related to lingual occlusion or crossbite. Early eruption of the permanent teeth was related to sturdiness. Sturdy children responded better to orthodontic treatment.

CEPHALOMETRICS

Le Gros Clark (1955) calls attention to the fallacies which occur in the quantitative assessment of taxonomic relationships. These apply equally to the assessment of ontogenetic growth and development.

Lundström (1953), Garber (1954), Sved (1954) and Salzmann and Ast (1955) question etiologic and diagnostic conclusions, and treatment planning based on cephalometric mean measurements. Applebaum (1953) and others warn against employing unstable landmarks in the growing child.

Björk and Palling (1955) caution that 'The value of biometrical methods in clinical diagnosis depends entirely on the user's appreciation of the limitations inherent in the method. . . . failing this, such methods may prove difficult to understand and may even be misleading.'

Cephalometrics provide an insight into the human growth pattern of the face and jaws. Clinical diagnosis along cephalometric determinations entails the weighing of many variable mean measurements which tend to modify each other and may even cancel out their respective contributory significance in the evaluation of the facial pattern as found in the individual patient.

Salzmann and Ast (1955) called attention to the need for the establishment of a 'normal range' of values about standard mean measurements to be used as *baselines.* Any measurements obtained in an individual child which fall outside the standard normal range, when such are established, would have

to be associated with an abnormal condition of dentofacial growth and malocclusion of the teeth and not be found also in children with normal dentofacial growth and occlusion, before they can be used as diagnostic criteria.

Björk and Palling (1955) found wide variation in sagittal jaw relation at age 20 years. They found also individual variations of the facial components with increasing age from 12 to 20 years to be proportional with the individual's variation in growth of the face and cranial base as a whole. Growth of facial components they found to be independent of growth and variation of dentoalveolar components while the latter in turn are closely dependent on the development of the face and sagittal jaw relationship. Changes in dentoalveolar components were mainly of a compensatory nature.

Henriques (1955) found mesiodistal relationships of the face to be more prognostic of dento-palato-facial relationships than are transverse relationships. This validates lateral cephalometric roentgenograms as an aid in dentofacial analysis.

Björk (1955 b) found the facial structures to vary in co-ordination with changes in the cranial base. During the change in the cranial base angle, he states, the glenoid fossa may be displaced in any direction, affecting the degree of protrusion of the mandible which in turn depends on the direction of growth increment at the condyle and the bodily displacement due to sutural growth of the cranial base.

Change at the gonial angle depends on the amount and direction of condylar growth in relation to the amount of appositional growth at the gonial angles. Brodie (1953) and Salzmann and Ast (1955) also found the gonial angle to vary widely in different individuals and in many cases in the same individual with age.

Cephalometric standards have been established also by Downs (1952), Hoffer (1954), Higley (1954), Margolis (1953), de Coster (1953), Moorrees (1953), Coutaud (1954), Sassouni (1955), Schwarz (1955 a, b), and many others. All indicate growth variations of the face and jaws to have etiologic implications in the establishment of malocclusion.

GROWTH AND DEVELOPMENT

a. General growth and development

Growth may be divided into somatogenetic and morphogenetic categories (Houssay, 1951). Somatogenetic growth is controlled by the so-called target glands: the thyroid, adrenals and gonads. Morphogenetic growth refers to growth of the skeleton and is controlled by the hypophysis.

Rabkin (1952) in a study of 125 embryos and fetuses found morphogenesis of the skeletal structure and the shaping of the individual followed an inherently established pattern during intra-uterine life.

Nicolson and Hanley (1953) have provided indices of physiological maturity. They found the chronologic age at which the largest increment in standing height occurs to be 11.5 years for girls and 13.8 years for boys. Harding (1952) has provided a method of evaluating osseous development from birth to 14 years.

b. Dento-facial growth and development.

Krogman (1951) states that while deficient growth and development can be responsible for malocclusion, favorable growth and development should also be given credit for much of the change achieved in orthodontic treatment of children before they reach terminal growth. Henriques (1955) found when skeletal growth and maturation keep pace with each other the dentofacial complex is more likely to show normal occlusion, otherwise malocclusion results. Posselt (1952) in a study of the movement of the human mandible describes the causes of limited movement.

Studies by Lebourg and Champagne (1951), Weyers (1955), and Politzer and Weizenberg (1955) on the disappearance of the mandibular suture at the symphysis during the embryonic stage show that it can lead to growth disturbance in the dentition as far as missing, neonatal, and supernumerary incisor teeth and malocclusion are concerned. This is due mainly to persistence of a crevice in the mandibular bone at its symphysis.

c. Tooth eruption and development of occlusion

Clements, Davies-Thomas and Pickett (1953) made exhaustive studies on tooth eruption in British children and have provided standards. A formula on eruption has also been suggested by Gisclard (1953). Meredith (1951) established an eruption chart on the deciduous teeth.

Friel (1954) describes ideal occlusion in its various stages. He presents evidence of root spacing with alveolar growth in the deciduous dentition and change of relationship of the mandibular arch to the maxillary arch between 3 and 8 years of age.

Lo and Moyers (1953) found the most frequently seen formula of eruption in the permanent dentition especially in females is:

$$\frac{6\ 1\ 2\ 4\ 5\ 3\ 7}{6\ 1\ 2\ 3\ 4\ 5\ 7}$$

The above provides the greatest incidence of normal molar relationships.

The most unfavorable sequence in the maxilla is when the second molar erupts earlier than either the premolars or the canine. In the mandible the most unfavorable sequence is when the canines erupted later than the premolars or where the second molar erupts prior to the canine or premolars. Class II malocclusions showed a strong tendency for maxillary molars to erupt prior to the mandibular molars.

Baume (1953) found eruption of the incisors into harmonious alignment to depend on (a) adequate perisoteal growth of the mandibular body in order to provide the tooth germs with the necessary bulk of basal bone, and (b) proper timing of the activity of the odontogenic epithelium at discrete areas of the cervical loop and succeeding Hertwig's sheath in order to induce the preeruptive movements of the tooth germs associated with bone transformations in the crypt and final formation of new alveolar bone.

Basal bone constitutes a developmental entity with the facial skeleton but growth of the alveolar process does not necessarily follow general growth

of the facial skeleton. This would indicate that early intervention in the mixed dentition can act as an interceptive measure in the development of malocclusion.

About 40 per cent of the arches without spacing in the deciduous dentition produced crowded permanent incisors.

Downward growth of the maxillary incisors is guided by the mandibular incisors. The longer the lower incisors remain lingual to the maxillary incisors, the further do the maxillary incisors erupt and increase the overbite (Baume, 1953). This is contrary to the belief that anterior overbite depends on the amount of eruption of the permanent molars.

Neumann (1954, 1955), in agreement with Baume, found regular arrangement of the maxillary incisors to occur more frequently in children who show anterior interdental spacing. Lind (1953) finds growth of the jaws to be responsible for good occlusion rather than the reverse to be the case.

d. Ankylosed teeth

These have been studied by Silver (1951), Korkhaus (1952), Dechaume, Couhépé and Marc (1953), and Euler (1955). Steinl (1955) considers the direct etiologic factor in arrested eruption of permanent teeth to be as yet unknown. Granse (1951) found fibrous ankylosis between the alveolar bone and areas of resorption at the bifurcation to be a prime factor.

Dixon (1954) describes two types of submerged teeth: (1) those with arrested eruption, and (2) those which erupted but were then submerged or failed to maintain their position relative to the line of occlusion. He reports a tooth in the body of the mandible but which had previously been erupted.

e. Ectopic eruption of canines

Saenz de la Calzada (1951) discussed transposition of teeth as a causative factor in malocclusion. Johansen (1954) gives two causes for canine retention: (1) displacement of the tooth germ, this he believes to be of genetic origin, with the tooth lying mesiopalatally; (2) persistence of deciduous canines which interfere with permanent canine eruption.

Fastlicht (1954) lists the following etiologic factors in ectopic eruption of canines: supernumerary teeth, cysts, prolonged retention or premature extraction of deciduous canines and deciduous first molars, and genetic factors; also in the type of canine eruption where the premolars and permanent second molars erupt before the permanent canines. In these instances the permanent canine usually is found to lie vestibularly and may erupt high on the labial surface of the alveolar process. Another factor is to be found in pseudoprognathism where the maxillary incisors occlude lingual to the mandibular incisors.

f. Supernumerary teeth

These are described and classified by Cadoni (1955) who also discusses germination of teeth and their pathogenicity in the deciduous and permanent dentitions. Saarenmaa (1951) concludes that supernumerary teeth cannot be progressive or regressive from a phylogenetic standpoint but must be looked

upon as sporadic phenomena. Schulze (1954) attributes supernumerary canines in the deciduous dentition to division of the tooth germ or overactivity of the dental lamina.

g. Malocclusion

Fleet (1953) found tooth size in Class I malocclusion with crowding to be on an average larger than in normal occlusion, but no significant correlation between the size of the teeth, length of the dental arches and the amount of tooth crowding.

Reichenbach and Taatz (1955) studied distocclusion in 100 children age 3 to 4 years who did not practice orodental pressure habits. They found 12 cases where the occlusion of the deciduous second molars was different on the right side from that on the left. Of the remaining 88 children 54 per cent showed the distal surfaces of the second molars to be along the same vertical plane; 39 per cent were in mesioclusion and 7 per cent in distocclusion. They distinguish between what Kantorowicz called a 'distalization' and a true distocclusion in the deciduous dentition. 'Distalization' may or may not show self-correction while distoclusion usually is a sign of true malocclusion.

Stoller (1954) found the mesiobuccal cusp of the maxillary permanent first molar to occlude slightly distal to the buccal groove of the mandibular first molar in normal occlusion. He advises examining the occlusion from casts where it is possible to observe molar relationship directly and not from an angle as seen in clinical examination of the mouth. Many cases of crowding are due to the slight forward occlusion of the first molars.

Hausser (1953) declared deep overbite to be due to dominant genetic origin. Depending on favorable or unfavorable environmental conditions, this anomaly can express itself as true overbite or as maxillary and mandibular protrusion, the inherent occlusal relationship being the deciding factor.

Prakash and Margolis (1952) found excessive overbite to be associated with infraclusion of the mandibular molars and supraclusion of the maxillary incisors with some infraclusion of the maxillary molars. They found the mandibular incisors not to be in supraclusion in cases of excessive overbite.

Moorrees and Reed (1954) found variation between tooth size and arch size play practically no part in crowding and spacing. Lundström (1955) found variation in tooth size to be positively related to malocclusion.

h. Diastemas

The cause of diastemas may be tongue or finger pressure, lip biting, endocrine disturbance, missing teeth, unerupted supernumerary teeth, maxillary incisor protraction, peg-shaped maxillary incisors and large mandibular incisors.

Loughlin (1952) presents the causes of anterior diastemas. Adams (1954) quotes Taylor that diastemas between the maxillary first incisors decrease with age of the child. In 6-year-old children Taylor found 97 per cent to show diastema but only 75 out of 1,068 children or 7 per cent had a diastema between the ages of 12 to 18 years.

Ceremello (1953) found little or no correlation between the frenum and the space between the first incisors. Bieber (1954) found a discrepancy in 25 per cent of the cases he examined between centric relation and centric occlusion.

The mandibular joint is not fully established until the deciduous dentition erupts and continues throughout life to accommodate itself to the occlusion of the teeth. The mandibular joint is not a causative factor in malocclusion (Salzmann, 1950).

MUSCLE FUNCTION

Gwynne-Evans (1952), Rix (1953), Tulley (1953), Ballard (1953), Ballard and Walther (1953), Scott (1954), Hovell (1955) and Pringle (1955) continue to stress the importance of muscle behavior and function in the etiology of malocclusion and the degree of success in treatment. Ballard attributes genetic influences to the behavior of the orofacial musculature.

Rix (1953) states that the stress of mastication determines the axial positions of the teeth. The method of swallowing adds to the molding forces created by mastication. Rix finds crossbites, openbites, overjet and overbite to be influenced by the manner of swallowing.

Baume (1955) found that absence or weakness of muscle rather than lack of function determines the extent of jaw growth. He concludes that the effect of muscular activity upon external bone formation is based upon a general biologic reaction and not a specific traction-pressure mechanism, as originally conceived by Roux and introduced into orthodontics by Häupl.

Hotz and Mühlemann (1952), however, found function to play an important role in occlusal anomalies. Basile (1953) considers the mimetic muscles to be a factor in certain types of malocclusion. He states that there is a direct relation between insufficient muscular function in the upper lip and the occlusion of the maxillary incisor teeth.

Brodie (1952) points out that the tongue at birth is further developed, to prepare the child for swallowing, than all other parts of the head except the brain and the eyeball. The tongue actually may be too far ahead of the development of the jaws. If the tongue is held so that it exerts its major force on the maxilla, the maxillary arch may become over-extended and completely enclose the mandibular arch. With overclosure of the jaws the tongue is forced backward into the pharynx. This causes difficulty in centric occlusion during mastication because of lessened space and gagging. The mandible goes through wide excursions in chewing and the teeth are abraded. Brodie (1952) states that the dental arch usually conforms to the tongue form. Long and narrow tongues will show long and narrow dental arches.

Class II div 1 or div 2, and Class III (Angle) malocclusions have muscular adaptations which aggravate the respective conditions. This is true especially of the lip factor in the development of Class II div 1 or Class II div 2 malocclusion.

Tongue position in Class III is in the mandibular space. The body of the mandible is not usually longer than in normal or Class II (Angle) malocclusion but the gonion angle is greater, giving a longer overall length to the mandible.

ENDOCRINES

Baume, Becks and Evans (1954) conclude that tooth eruption in rats is affected by a synergism of both growth hormone and thyroxin. Pituitary growth hormone stimulates basic growth and thyroid hormone controls differentiation or maturation.

Salzmann (1954) states that the elimination of endocrine disturbances in young children can obviate and correct some dentofacial abnormalities. Endocrine dysfunction may show itself in disturbed tooth development and eruption in the rate and direction of skeletal growth and development and in the soft tissues of the mouth. The effects produced depend on the age of the patient at the onset and on the duration of the disturbance. Both general growth retardation and acceleration can, but do not always, affect the rate of development, eruption and occlusion of the teeth and face.

Dental retardation in hypothyroidism parallels endochondral ossification, which is extremely delayed. Delay of ossification of the tooth buds is more significant in these cases than retarded eruption.

Salzmann and Wein (1952) found that deficiency of the anterior lobe of the pituitary gland in early childhood shows itself dentofacially in lack or delay in development and growth and in prolonged retention of deciduous teeth, with retardation of formation and eruption of permanent teeth. There is persistence of juvenile facial and dental characteristics such as delayed growth of tooth roots, parallel wide pulpal walls, and retardation of closure of the apical foramina. Crowding of teeth is not pathognomonic but there is a tendency toward development of deep overbite, with deficiency of vertical growth of the face. In the Lorain type of dwarf and hypopituitarism of congenital origin the teeth are small and there is no crowding. Salzmann and Wein (1952) found the dental development in hypopituitarism in a boy age 15 years to show a disturbed pattern of tooth development and eruption but nothing pathognomonic in the occlusion itself.

Hausser (1954) is in agreement with the foregoing dental findings in endocrine disturbances. Brown (1953) calls attention to subclinical acromegalic changes which are stimulated by chronic sinusitis rather than by a tumor of the hypophysis. He feels that progressive spacing of the teeth should make one look for subclinical acromegalic symptoms.

Gosman (1951) discusses the occlusal and dentofacial changes in mongolism. These patients show under-development in the middleface anteroposterior dimension. There is progressive mandibular prognathism, crossbite and openbite.

Bataille (1953) reports 2 cases of alveolysis of the mixed dentition in keratoderma palmoplantar or Papillon-Lefevre's disease. At age 11 the patient had lost the permanent incisors. He reports a second case in a 3-year-old child who had lost all of his deciduous teeth. Tager (1951) conducted metabolic studies in over 100 affected children who showed roentgenographic evidence of root resorption, alveolar osteoporosis and other evidence of bone dyscrasia.

NUTRITION

Salembier and Soleil (1954) found in the rat fissuring and clefts of the palate, atrophy of the nasal cavity and other cranio-facial changes in avitaminosis. Warkany and Deuschle (1955) produced congenital dentofacial anomalies in rats by maternal riboflavin deficiency. Among these were shortness and contraction of the mandible, clefts of the palate, and interferences with tooth formation and eruption. Cohalan (1953) found excessive vitamin A to cause congenital anomalies in the rat.

Pottenger (1952) correlated nutritional status and developmental factors in the face and jaws. Korkhaus (1953), Watt and Williams (1951), and Newman (1952) call attention to the effect of the physical nature of food on jaw growth. Growth failure is usually associated with feeding problems, circulatory and gastro-intestinal diseases and allergies (Crump and Tully, 1955.)

DISEASE

Stafne (1952) discusses dental manifestations of systemic disease. Beysac (1953) presents the effects of gingival hypertrophy in blood dyscrasias on dental occlusion.

Wallis (1953) submits that distocclusion is related to (1) genetic factors, (2) low birth weight, (3) artificial feeding, (4) sucking habits, (5) removal of tonsils and adenoids and (6) asthma.

Pruzansky (1953) and Daniel (1955) studied dentofacial effects in poliomyelitis. Pruzansky found a compensatory pattern of contraction of the mimetic muscles in the attempt to overcome weakness of the masseter and temporal muscles in elevating the mandible. Tongue thrusting, severe open bite, reduced dental arch lengths, and high palatal vaults were seen.

In bulbar-spinal myelitis, Daniel (1955) reported maxillary protrusion with procumbency of the anterior teeth. The mandible appeared retruded and there was lingual collapse of the mandibular incisors. It is not known whether these patients have a favorable orthodontic prognosis.

White and Sackler (1954) in a study of malocclusion in progressive muscular dystrophy, postmyolytic paralysis and encephalitis find dysfunction or hyperfunction to be the causative agent in malocclusion. Lyons (1951) found spastic or athetoid children who lack muscular control and equilibrium to be poor orthodontic risks.

A systematic analysis and classification of dento-facial abnormalities in cerebral palsy was made by Jackson (1955) who found the deciduous dentitions to show a greater number of normal occlusions and malocclusions of a less severe nature than in mixed or permanent dentitions. Temporomandibular disturbances were found in 36 per cent of cerebral palsied patients. Trausch (1955) found a positive relationship between cerebral palsy and eccentric muscular activity, dento-alveolar deviations and impaired tongue function.

Soleil (1953) presents complications of the teeth and jaw bones following radiotherapy. Wilson (1954) reports a patient treated with radon seeds at the age of 4 months for carcinoma of the left side of the palate. Examination

revealed deformity and destruction of all dental structures on the left side of the face. The degree of deformity depends on the proximity of the part to the center of radiation. The teeth affected showed absent or shortened roots. Similar findings have been reported by other observers. Murai (1954) reported underdevelopment of the jaws and early loss of teeth. The crowns of the permanent dentition were small.

PREVENTION

PUBLIC HEALTH OR "SOCIAL" ORTHODONTICS

In the United States, what is known as 'public health orthodontics' and in Europe 'social orthodontics,' is receiving increasing attention. The effectiveness of 'public health' or 'social orthodontics' lies in the development of preventive and interceptive measures.

Hotz (1954) speaks of 'social indication' for extraction of permanent first molars. This he points out does not refer to the inability of the patient to pay for conservative treatment. It means, according to Hotz, that when the government takes over the dental treatment of children, it assumes also the right to limit the treatment and to decide on compromises of treatment as against ideal results.

Description of orthodontic programs in public health have been presented by Salzmann et al. (1951), Nord (1953), Bushell and Ast (1953), Strusser and Simon (1954), Hotz (1954), Schwarz (1953), Schmitz (1955) and many others. All agree that prevention is the only method for benefiting large groups of patients.

Nord (1953) states that prevention in orthodontics starts with the expectant mother, continues with the baby and goes on with the child through the deciduous, mixed and permanent dentitions. Anderson (1951) and Waugh (1955) point out that prevention is largely in the hands of the general dentist and only rarely in those of the specialist. Ailianos (1954), Sunde (1952), Salzmann (1952) and Waugh (1955) call attention to the importance of fillings and space maintenance as preventive measures, which the general practitioner should heed.

PREVENTION IN PRIVATE PRACTICE

Hotz (1954) outlines procedures in preventive orthodontics for the general practitioner of dentistry. Schwarz (1955 b) presents 10 commandments for the general practitioner of dentistry which include the following advice: (1) every young patient should be examined from the orthodontic standpoint; (2) inform parents of any present occlusal abnormality and when the deciduous dentition indicates that the child may later require orthodontic treatment; (3) eliminate pressure habits, and correct mouth breathing; (4) watch for early loss and prolonged retention of teeth; (5) do not extract canines which erupt out of alignment; (6) do not extract permanent first molars in good condition for orthodontic purposes.

Reichenbach and Neumann (1952) and Poole (1954) advocate grinding of the deciduous canine incisal tips to permit free lateral excursion of the mandible, to prevent distal positioning of the mandible and to correct early crossbite.

Ballard and Walther (1953) present the following factors to be determined in the prevention of malocclusion as well as in the diagnosis, treatment planning, and prognosis of manifest malocclusions: (1) the inherent pattern of growth and development, (2) soft tissue behavior of the facio-dental area, (3) postural movements of the mandible with special reference to condylar movement and position, (4) relationship between tooth size and arch size in crowding and spacing.

SERIAL EXTRACTION

Brückl and Steinle (1953), Dewel (1954) and others discuss serial extractions in guiding tooth eruption. In serial extraction as originally explained by Kjellgen, the deciduous second incisors and deciduous canines are extracted to make room for the crowded permanent first and second incisors. When the first premolar is about to erupt it is extracted to make room for the blocked out canine. Serial extraction requires a fine sense of diagnosis and timing and should be performed after careful periodic examinations only.

Serial extraction is contra-indicated where only a slight irregularity is present in the erupting incisors or if the mandibular dental arch shows favorable growth. Premature loss of deciduous canine teeth at the eruption of the permanent lateral incisors is the result of inadequate arch growth, not the cause of it.

SELF-CORRECTION

Korkhaus (1955) found malocclusion in some children to show self-correction, especially spacing of the maxillary first incisors with completion of eruption of the permanent dentition. There may be self-correction of protrusion of maxillary incisors in the absence of lateral compression of the dental arch. Self-correction he also found in some cases of unilateral crossbite and in edge-to-edge bite in the deciduous dentition.

MOUTH BREATHING

Ballard (1953) states that in short-lipped individuals a conscious effort is required to obtain nasal respiration. There are mouth breathers without nasal obstruction where the lip is short and tongue position is abnormal, making it easier for the child to breathe through the mouth.

Eckert-Möbius (1953), in a detailed review, found that some of the accompanying phenomena in mouth breathers are flat chest and poor aeration of the upper lung spaces and perversion of the entire muscle complex of the face, throat and upper chest. Lepre (1955) considers mouth breathing an etiologic factor in malocclusion because of the abnormal muscular action.

Gerlach (1953), in describing the correlation between mouth breathing and malocclusion, finds the cause and effect relationship to be affected by

many circumstances. This she states has led to differences of opinion on causal relationship. Certain dental anomalies can affect the manner of respiration and vice versa.

PRESSURE HABITS

Salzmann (1953) states that the effect of abnormal pressure on the teeth, dental arches, occlusion and on the jaws themselves depends on the frequency and duration of the pressure habit and on the osteogenic development, genetic endowment, state of general health and on the inherent type of occlusion in the individual child. Salzmann does not agree with Sillman (1951) that 'thumbsucking was prone to affect those with poor bites but had little or no effect on the good bites.'

Townsend (1954) discusses the importance of maintaining the equilibrium of the dentofacial complex. He found deleterious effects of sucking habits on the occlusion of the teeth in identical twins. Mack (1951) found as little as 50 mg of continuous pressure over 12 hours will cause measurable displacement of a tooth and that thumbsucking may cause openbite as well as constriction of both dental arches. Ruttle, Quigley, Crouch and Ewan (1953) reached similar conclusions.

Lerner (1955) in a study of sixty-four casts of thumb-sucking children states that thumbsucking deformity usually involves the anterior component of the dental arch. Evidence that thumbsucking is related to Class II (Angle) malocclusion was inconclusive.

Sullivan (1954) finds thumbsucking in older children a sign that the child is ill, tired, frightened, angry or frustrated. Lawes (1950), Littlefield (1952) and Altermann (1954) all arrived at similar conclusions.

Malone and Massler (1952) studied nailbiting in 4,587 children age 5 to 18 years. While the degree of nailbiting may vary from mild to severe, most children bite all 10 fingers to a severe degree. Between 10 to 18 years of age there were 10 per cent less girls who bit their nails than boys. Selbach (1955) discusses the psychotherapeutic and local measures in treating nailbiting.

Weder (1954) advises the use of plumpers in treating lip biting. The plumper is attached to the mandibular dental arch to keep the lower lip from being bitten.

Tongue sucking is an activity similar to thumbsucking and usually disappears about the second year of life. It may be a substitute habit when thumbsucking is prohibited. If persisted in later childhood there may be an organic background such as oral irritations or allergy. It may also be due to macroglossia, especially in cretins and in mongolian idiots. Emotional disturbances should be looked for. Substitute chewing and sucking of innocuous objects such as pacifiers and nutritional sucking may be attempted (Gorelick 1955).

INDICATIONS FOR THE USE OF SPACE MAINTAINERS

1. When calcification of the succedaneous permanent tooth root shows less than one-third calcification and alveolar bone overlies the occlusal surface of the unerupted permanent tooth.

2. When the space is equal to or smaller mesio-distally than the succeeding permanent tooth as measured on the roentgenogram.
3. Where the succeeding permanent tooth is absent and it is necessary to preserve the space for the normal establishment of the occlusion.

CONTRA-INDICATIONS TO SPACE MAINTENANCE

1. When the foregoing indications do not apply.
2. Where the general arrangement of the teeth indicates extraction as an adjunct of orthodontic treatment.

Davies (1952) gives four criteria for an ideal space maintainer.

1. Retains full mesiodistal diameter of space.
2. Permits normal growth of the teeth and alveolar process and tooth eruption.
3. Does not interfere with function or functional movement of the teeth.
4. Prevents over-eruption in the opposing arch.

Olsen (1953) and Pries (1953) caution that the insertion of space maintainers requires the consideration of the growth and development of the child as well as of the dentition.

Herrick (1955) demonstrated the construction of a space maintainer and space opener which has an acrylic body to occupy the extraction space. A slit in the acrylic divides it buccolingually. Opening the loops to which the acrylic is attached and wedging the space maintainer into place provides pressure to move the teeth apart.

Whitman (1953) enlists the aid of the child in treating pressure habits. He instills confidence in the child, then gives him simple exercises in habit breaking. His use of sedatives as a habit breaker is questionable. The use of a mirror in teaching the child to overcome the open-bite swallowing habit is a useful procedure.

Berger (1954) urges care in inserting orthodontic appliances in children, whether for preventive, interceptive or therapeutic purposes. Carelessness, says Berger, leaves 'scars' of treatment which may set up new pathologic conditions.

BIBLIOGRAPHY

ADAMS, C. P. (1954): 'The dento-facial complex', *Dent. Record*, **74**, 3.
ADORNI-BRACCESI and LUZJ, C. (1954): 'Angle facial et constitution: Deuxième contribution', *Soc. Française d'Orthopédie*, Vol. 25.
AILIANOS, J. C. (1954): 'Orthodontie preventive', *Soc. Française d'Orthopédie*, Dento-Faciale V 24.
ALTERMANN, S. (1954): 'Lidt om Problemet Fingersutning', *Tandlægebladet*, **56**, 57.
ANDERSON, G. M. (1951): 'Discussion with parents and supporting correspondence relative to initiating orthodontic treatment', *Amer. J. Orthod.*, **37**, 809.
APPLEBAUM, E. (1953): 'Integration of anatomic and cephalometric studies of growth of the head', *Amer. J. Orthod.*, **39**, 612.
BALLARD, C. F. (1953): 'The significance of soft tissue morphology in diagnosis, prognosis and treatment planning', *Trans. European Orthod. Soc.* **137**.
— and WALTHER, D. P. (1953): 'Some cases to illustrate the relationship between aetiology, prognosis and treatment planning in orthodontics', *Dent. Record*, **73**, 669.
BARBARA, M. (1951): 'Sviluppo corpore o constituzione individuale', *Minerva Pediat.*, **3** (1), 13.
BASILE, E. (1953): 'La muscolatura mimica della faccia e il suo ruolo nella patagenesi di alcune malocclusioni', *Clinica Odontoiat.*, **8**, 12.

BATAILLE, M. R. (1953): 'Les Paradontoses des keratodermies palmo-plantaires la maladie de Meleda', *Rev. Stomat.*, **54**, 139.

BAUME, L. J. (1953): 'The development of the lower permanent incisors and their supporting bone', *Amer. J. Orthod.*, **39**, 526.

—, (1955): 'Muskelansatz und Knochenwachstum', *Schweiz. Monatschr. f. Zahnheilk.*, **65**, 18.

—, BECKS, H. and EVANS, H. M. (1954): 'Hormonal control of tooth eruption. I. The effect of thyroidectomy on the upper rat incisor and the response to growth hormone, thyroxin or the combination of both. II. The effects of hypophysectomy on the upper rat incisor following progressively longer intervals. III. The response of the incisors of hypophysectomized rats to growth hormone, thyroxin or the combination of both', *J. Dent. Res.*, **33**, 80, 91, 104.

BERGER, H. (1954): 'Safety measures in orthodontic treatment', *Dent. Mag. and Oral topics*, **71**, 9.

BEYSAC, P. (1953): 'Hypertrophies — Hyperplasies gingivales spécialement dans les états hémopathiques graves', *Ann. Odonto-Stomatol.*, **10**, 117.

BIEBER, S. (1954): 'Contribution a l'étude des relations entre les occlusions dentaires et l'articulation temporomandibulaire', *Schweiz. Monatschr. f. Zahnheilk.*, **64**, 315.

BJÖRK, A. (1955 a): 'Bite development and body build', *Dent. Record*, **75**, 8.

—, (1955 b): 'Cranial base development', *Amer. J. Orthod.*, **41**, 198.

—, (1955): 'Facial growth in man: studied with the aid of metallic implants', *Acta Odont. Scand.*, **13**, 9.

— and PALLING, M. (1955): 'Adolescent age changes in sagittal jaw relation, alveolar prognathy, and incisal inclination', *Acta Odontol, Scand.*, **12**, 201.

BODER, E. (1953): 'A common form of facial asymmetry in the newborn infant: its etiology and orthodontic significance', *Amer. J. Orthod.*, **39**, 895.

BOUYSSOU, M. (1953): 'Polydysplasie ectodermique atypique avec myxœdème. Effets du traitement par la thyroxine', *Rev. Stomat.*, **54**, 161.

BRODIE, A. G. (1952): 'Consideration of musculature in diagnosis and treatment', *Amer. J. Orthod.*, **38**, 823.

—, (1953): 'Late growth changes in the human face', *Angle Orthodontist*, **23**, 146.

BROWN, E. E. (1953): 'Interdental separation in subclinical acromegaly caused by sinusitis', *Amer. J. Orthod.*, **39**, 932.

BRÜCKL, H. and STEINLE, B. (1953): 'Erfahrungen mit der Steuerung des Zahndurchbruchs' nach Hotz', *Deutsche Zahn-, Mund- u. Kieferheilk.*, **17**, 416.

BUSHEL, A. and AST, D. B. (1953): 'A rehabilitation program for the dentally physically handicapped child', *Amer. J. Pub. Health*, **43**, 1156.

CADONI, U. (1955): 'Su alcuni casi di anomalie dentarie in soprannumero', *Clinica Odontriat.*, **10**, 158.

CEREMELLO, P. J. (1953): 'The superior palatal frenum and the midline diastema and their relation to growth and development of the oral structures', *Amer. J. Orthod.*, **39**, 120.

CHATELLIER, J. and CHATEAU, M. (1955): 'Absence congénitale d'un condyle mandibulaire', *Rev. Stomatol.*, **56**, 278.

CLEMENTS, E. M. B.; DAVIES-THOMAS, E. and PICKETT, K. G. (1953): 'Time of eruption of permanent teeth in British children in 1947-8', *Brit. Med. J.*, i 1421.

COHALAN, S. Q. (1953): 'Excessive intake of vitamin A as a cause of congenital anomalies in the rat', *Science*, **117**, 535.

COHEN, M. M. and GARN, S. M. (1954): 'Factors in Occlusion', *Amer. J. Orthod.*, **40**, 671.

COSTER, L. DE (1953): 'A new line of reference for the study of lateral teleradiographs', *Amer. J. Orthod.*, **39**, 304.

—, (1955): 'Les tendances en orthodontie', *Fortschr. d. Kieferorthopäd.*, **16**, 22.

COURTNER, R. M. (1953): 'Predetermination of the adult face', *Amer. J. Orthod.*, **39**, 201.

COUTAUD, A. (1954): 'Étude analytique de la téléoradiographie', *Soc. Franç. d'Orthopéd. Dento-Faciale.* Comptes rendus du XXVIIe congrés annuel. Paris Vol. 25.

CRUMP, J. and TULLY, R. (1955): 'The use of partial vitamin supplements in the treatment of growth failures in children', *J. Pediat.*, **46**, 671.

DANIEL, R. G. (1955): 'An evaluation of the effects of bulbar-spinal poliomyelitis on the occlusion of the teeth', *Amer. J. Orthod.*, **41**, 721.

DAVIES, G. N. (1952): 'Prevention of malocclusion', *New Zealand Dental J.*, **48**, 123.

DECHAUME, M.; CAUHÉPÉ, J. and DUBRUILLE, J. (1954): 'L'émiatrophie faciale progressive', *Rev. Stomatol.*, **55**, 12.

—, and MARC (1953): 'Contribution à l'étude de la rétention des molaires temporaires', *Rev. Stomatol.*, **54**, 130.

DEWEL, B. F. (1954): 'Serial extraction in orthodontics: indications, objectives and treatment procedures', *Amer. J. Orthod.*, **40**, 906.

DIXON, D. A. (1954): 'Submerged teeth', *Brit. Dent. J.* **97**, 325.

DOBZHANSKY, T. (1954): 'Review of "Facts of life",' *Amer. J. Phys. Anthropol.*, **12**, 619.

DOWNS, W. B. (1952): 'The role of cephalometrics in orthodontic case analysis and diagnosis', *Amer. J. Orthod.*, **38**, 162.
ECKERT-MÖBIUS, A. (1953): 'Normale und pathologische Physiologie der Nasen- und Mundatmung', *Deutsche Zahn-, Mund- und Kieferheilkunde*, **18**, 345.
EULER, H. (1955): 'Zahnretention und Herdlehre', *Deutsche Zahn-, Mund- u. Kieferheilkunde* **22**, 84.
FASTLICHT, S. (1954): 'Treatment of impacted canines', *Amer. J. Orthod.*, **40**, 891.
FLEET, I. J. (1953): 'A study of tooth size, dental arch length, and facial balance in cases of Class I (Angle) malocclusion', *Amer. J. Orthod.*, **39**, 57.
FRASER, F. C. and FAINSTAT, T. D. (1951): 'The causes of congenital defects', *Amer. J. Dis. Child*, **82**, 593.
FRIEL, S. (1954): 'The development of ideal occlusion of the gum pads and the teeth', *Amer. J. Orthod.*, **40**, 196.
GERLACH, H. (1953): 'Klinische Erfahrungen über die Korrelation von Mundatmung und Kieferanomalien', *Deutsche Zahnärztl. Zeitschr.*, **8**, 974.
—, (1952): 'Über die Individualität und den Typenbegriff in der kieferorthopädischen Diagnostik', *Deutsche Zahn. Z.* **7**, 1.
GISCLARD, L. F. (1953): 'Notes sur l'établissement d'une formule d'éruption dentaire', *Rev. Stomatol.*, **54**, 226.
GOLDSTEIN, A. (1953): 'The dominance of the morophological pattern: implications for treatment', *Angle Orthod.*, **23**, 187.
GORELICK, L. (1955): 'On the use of pacifiers in preventing malocclusion', *N. Y. State Dent. Jour.*, **21**, 3.
GOSMAN, S. D. (1951): 'Facial development in mongolism', *Amer. Jour. Orthod.*, **37**: 332.
GRABER, T. M (1954): 'A critical review of clinical cephalometric radiography', *Amer. J. Orthod.*, **40**, 1.
GRANSE, K. A. (1951): 'Infraocclusioner av Sex-Årsmolarer', *Odontologisk Tidsk.*, **5**, 336.
GWYNNE-EVANS, E. (1952): 'An analysis of the orofacial structures with special reference to muscle behavior and dental alignment', *Speech*, **16**, 36.
HARALABAKIS, H. (1954): 'Familial resemblances in cranio-facial osteology as revealed by cephalometric x-rays in Greek families', *Amer. J. Orthod.*, **40**, 233.
HARDING, V. S. V. (1952): 'A method of evaluating osseous development from birth to 14 years', *Child Development*, **23**, 247.
HARTMAN, E. E. and KENNEDY, R. L. J. (1951): 'Illness in the first trimester of pregnancy: Its lack of significance in relation to congenital anomaly of the offspring and to full-term pregnancy, prematurity and stillbirth', *J. Pediat.*, **38**, 306.
HARVOLD, E. (1953) 'Cleft lip and palate', *Amer. J. Orthod.*, **40**, 493.
HATTON, M. E. (1955): 'A measure of the effects of heredity and environment on eruption of the deciduous teeth', *J. Dent. Res.*, **34**, 397.
HAUSSER, (1953): 'Zur Ätiologie und Genese des Deckbisses', *Fortschr. d. Kieferorthopädie*, **14**, 154.
—, E. (1954): 'Ätiologie und Genese der Gebißanomalien', *Fortschr. d. Kieferorthopädie*, **15**, 101.
HENRIQUES, A. C. (1955): 'A correlative study of palatofacial growth using the cephalometric and roentgenographic cephalometric techniques', *Amer. J. Orthod.*, **41**, 152.
HERRICK, P. W. (1955): 'Rapid construction of a space maintainer which can be used as an orthodontic appliance', *J. Pros. Dent.*, **5**, 66.
HIGLEY, L. B. (1954): 'Cephalometric standards for children 4 to 8 years of age', *Amer. J. Orthod.*, **40**, 51.
HOFFER, O. (1954 a): 'Disgnozie E. Biotipi', *Clinica Odontoiatrica*, **9**, 1.
—, (1954 b): 'L'importanza della dominante ereditaria nelle anomalie maxillo-facciali', *Analecta Genetica*, **1**, 1352.
—, (1954): 'L'interprétation du téléradiogramme a l'aide du radiogramme crânio-facial en orthopédie maxillo-faciale', *Soc. Française d'Orthopédie Dento-Faciale* V. 25.
HOTZ, R. (1954): 'Orthodontie in der Täglichen Praxis', Bern, Switzerland, Hans Huber.
—, and MÜHLEMANN, H. (1952): 'Die Funktion in der Beurteilung und Therapie von Bißanomalien', *Schweiz. Monatschr. f. Zahnheilkunde*, **62**, 592.
HOUSSAY, B. A. (1951): 'Human physiology', New York, *McGraw-Hill Book Company.*
HOVELL, J. H. (1955): 'Recent advances in orthodontics', *British Dent. J.*, **98**, 114.
HUTCHINSON, A. C. W. (1953): 'A case of total anodontia of the permanent dentition', *Brit. Dent. J.*, **94**, 16.
INGALLS, T. H. (1953): 'Principles underlying experimentally induced malformations. In prematurity, congenital malformations and birth injuries', New York, *Proceedings, Conference Association for the Aid of Crippled Children of the New York Academy of Medicine.*
JACKSON, G. E. (1955): 'A systematic analysis and classification of the dento-facial abnormalities shown in cerebral palsy', *Amer. J. Orthod.*, **41**, 29.
JARABAK, J. R. (1954): 'Subcondylar fractures of the mandible: research and treatment', *Amer. J. Orthod.*, **40**, 729.

JOHANSEN, E. A. S. (1954): 'Retensjon av den makselläere hjornetann', *Den Norske Tannlægeforenings Tid.*, **64**, 359.
KETTLE, M. A. (1954): 'I. A symposium on cleft palate. II. The development of the orthodontic problem', *Dent. Practit.*, **5**, 23.
KORKHAUS, G. (1952): 'Reihenuntersuchungen zur Genese der Gebißanomalien', *Österreich, Zeitschr. f. Stomatol.*, **49**, 127.
—, (1953): 'Ernährung und Kiefer', *Deutsch. Zahnärztl. Zeitschr.*, Supp., **8**, 24.
—, (1954): 'Genotypische und paratypische Einflüsse beim Aufbau von Gebiß und Gesichtsschädel', *Analecta Genetica*, **1**, 344.
—, (1955): 'The forces involved in self-correcting occlusal anomalies and their application to the early orthodontic treatment', *Internat. Dent. J.* **5**, 3.
KROGMAN, W. M. (1951): 'The problem of "timing" in facial growth, with special reference to the period of the changing dentition', *Amer. J. Orthod.*, **37**, 253.
KRUGMAN, S. and WARD, R. (1954): 'The rubella problem', *J. Pediat.*, **44**, 489.
LAWES, A. G. H. (1950): 'A psychosomatic study into the prevention and treatment of thumbsucking and its relationship to dental deformity', *Dent. J. Australia*, **22**, 167.
LEBOURG, L. and CHAMPAGNE, C. (1951): 'A propos du développement mandibulaire postnatal. Précisions sur la chronologie de la suture symphysaire', *Rev. Stomatol.*, **52**, 89.
LE GROS CLARK, W. E. (1955): 'The Fossil evidence for human evolution, an introduction to the study of paleoanthropology', Chicago, *University of Chicago Press.*
LEPRE, N. C. (1955): 'La Respiración bucal en la etiopatogenia de las anomaliás dentomaxilofaciales', *La Trib. Odontol.*, **39**, 84.
LERNER, H. I. (1955): 'Thumbsucking and dental occlusion: a serial study', *Amer. J. Orthod.*, **41**, 640.
LIND, V. (1953): 'Über die normalen Wachstums und Entwicklungsveränderungen der Zahnbögen und der Okklusion', *Odont. Rev.*, **4**, 139.
LINDEGARD, B. (1953) 'Variations in human body build: a somatic and x-ray cephalometric investigation on Scandinavian adults', *Acta Psychiat. et Neurol.*, Supp. 86, Copenhagen.
LITTLEFILD, W. H. (1952): 'Thumbsucking and its relationship to malocclusion in children', *Amer. J. Orthod.*, **38**, 293.
LO, R. T. and MOYERS, R. E. (1953): 'Studies in the etiology and prevention of malocclusion', *Amer. J. Orthod.*, **39**, 460.
LOUGHLIN, F. J. (1952): 'Aims, aids and auxilliaries', *Amer. J. Orthod.*, **38**, 315.
LUNDSTRÖM, A. (1953): 'Cephalometric registrations as an aid in diagnosing malocclusions', *Acta Odont. Scand.*, **11**, 100.
—, (1955): 'Variation in tooth size in the etiology of malocclusion', *Amer. J. Orthod.*, **41**, 872.
LYONS, D. C. (1951): 'The dental problem of the spastic or the athetoid child', *Amer. J. Orthod.*, **37**, 129.
MACK, E. S. (1951): 'The dilemma in the management of thumbsucking', *J. Amer. Dent. Ass.*, **43**, 33.
MAJ, G., LUCCHESE, P. and MIOTTE, B. (1954): 'Étude des relations existant entre la forme et les proportions du crâne et de la face par rapport à la constitution', *Soc. Française d'Orthoped. Dento-Faciale*, Vol. 25.
MALONE, A. J. and MASSLER, M. (1952): 'Index of nailbiting in children', *J. Abnorm. and Social Psychol.*, **47**, 193.
MARGOLIS, H. I. (1953): 'A basic facial pattern and its application in clinical orthodontics', *Amer. J. Orthod.*, **39**, 425.
MEREDITH, H. V. (1951): 'A chart on eruption of the deciduous teeth for the pediatrician's office', *J. Pediat.*, **38**, 482.
MOORREES, C. F. A. (1953): 'Normal variation and its bearing on the use of cephalometric radiography in orthodontic diagnosis', *Amer. J. Orthod.*, **39**, 942.
—, and REED, R. B. (1954): 'Biometrics of crowding and spacing of the teeth in the mandible', *Amer. J. Phys. Anthropol.*, **12**, 77.
MURAI, T. (1954): 'Case report of radiation injury of teeth and jaws', *Bull. Tokyo Med. Dent. Univ.*, **1**, 73.
MURPHY, D. P. (1954): 'The birth of congenitally malformed children in relation to maternal age', *Ann. N. Y. Acad. Sci.*, **57**, 503.
MUZJ, E.; MAJ, G. and LUCCHESE, P. (1954): 'L'Angularité du profil étudiée par rapport à la constitution', *Soc. Française d'Orthopéd. Dento-Faciale*, V. 25.
NANDA, R. S. (1954): 'Agenesis of the third molar in man,' *Amer. J. Orthod.*, **40**, 698.
NEUMANN, D. (1954): 'Untersuchungen über Gebißentwicklung', *Deutsche Zahn-, Mund- u. Kieferheilk.*, **20**, 177; 285.
—, (1955): 'Weitere Untersuchungen über die Gebißentwicklung an Hand von Reihenuntersuchungen bei Kindern in 10. Lebensjahr', *Deutsche Zahn-, Mund- u. Kiefer.*, **22**, 157.
NEWMAN, G. V. (1952): 'The Eskimo's dentofacial complex. Effects of environmental factors', *U. S. Armed Forces Med. J.* **3**, 1653.

NICOLSON, A. B. and HANLEY, C. (1953): 'Indices of physiological maturity: derivation and interrelationships', *Child Development*, **24**, 3.
NORD, CH. F. L. (1953): 'Prevention in dento-facial orthopaedia', *Internat. Dent. J.*, **4**, 145.
OLSEN, N. H. (1953): 'Space maintenance for children', *J. Amer. Dent. Ass.*, **46**, 386.
POLITZER, G. and WEIZENBERG, J. (1955): 'Normale und abnorme Unterkiefermitte', *Deutsche Zahnärztl. Zeitschr.*, **11**, 801.
POOLE, A. W. (1954): 'Table demonstration of orthodontia without appliance', *Brit. Dent. J.*, **96**, 142.
POSSELT, U. (1952): 'Studies in the mobility of the human mandible', *Acta Scandinavica Odont.*, V. 10, Supp. 10.
POTTENGER, F. M. (1952): 'The effects of disturbed nutrition on dento-facial structures', *S. Calif. State Dent.*, **20**, 18.
PRAKASH, P. and MAGOLIS, H. I. (1952): 'Dento-craniofacial relations in varying degrees of overbite', *Amer. J. Orthod.*, **38**, 657.
PREIS, K. W. (1953): 'Childhood habits: their effect on facial development and dental occlusion', *Ann. Dent.* **12**, 58.
PRINGLE, K. E. (1955): 'Long term results of orthodontic treatment', *Dent. Pract.*, **5**, 297.
PRUZANSKY, S. (1955): 'Factors determining arch form in clefts of the lip and palate', *Amer. J. Orthod.*, **41**, 827.
—, (1953): 'Alterations in the masticatory mechanism as a consequence of bulbar poliomyelitis', *Amer. J. Orthod.*, **39**, 711.
RAVKIN, S. (1952): 'Variations in structural morphogenesis of the human face and jaws: initial stages of normal and abnormal bone formation (gross) exhibited in the cleared embryo and fetus', *J. Dent. Res.* **31**, 535.
REICHENBACH, E. and NEUMANN, D. (1952): 'Der Seitbiß, seine Ursache und seine Behandlung', *Deutsche Zahn-, Mund- u. Kieferheilk.*, **15**, 265; 375.
—, TAATZ, A. (1955): 'Untersuchungen zur Frage der Diagnose', '' 'Distalbiß'' im Milchgebiß', *Deutsche Zahn- Mund- u. Kieferheilk.*, **22**, 152.
REITAN, K. (1953): 'Oigo-og Anodonti', *Den Noske Tan. Tid.*, **63**, 65.
RIX, R. E. (1953): 'Some observations upon the environment of the incisors', *Dent. Record*, **73**, 427.
RUSHTON, M. A. (1951): 'Unilateral hyperplasia of the jaws of the young', *Internat. Dent. J.*, **1**, 41.
RUTTLE, A. T.; QUIGLEY, W.; CROUTCH, J. T. and EWAN, G. E. (1953): 'A serial study of the effects of fingersucking', *J. Dent. Res.*, **32**, 739.
SAARENMAA, L. (1951): 'The origin of supernumerary teeth', *Acta Odont. Scand.*, **9**, 293.
SAENZ DE LA CALZADA, I. (1951): 'Transposiciones Dentrias', *An. Españ. Odontoestom.*, **10**, 925.
SALEMBIER, Y. and SOLEIL, J. (1954): 'Avitominoses et embryogénèses du canal naso-palaten', *Soc. Française d'Orthopéd. Dento-Faciale*, V. 25.
SALZMANN, J. A. (1950): 'Principles of orthodontics', J. B. Lippincott Co., Philadelphia.
—, (1952): 'Orthodontic approach to the interception and treatment of oral habits in children', *J. Dent. Child.*, **19**, 90.
—, (1953): 'Facial asymmetry in the newborn', *Amer. J. Orthod.*, **39**, 954.
—, (1954): 'General growth acceleration and retardation in relation to dentofacial development', *Amer. J. Orthod.*, **40**, 243.
—, and AST, D. B. (1955): 'The Newburgh-Kingston Fluorine Study. IX. Dentofacial growth and development—cephalometric study', *Amer. J. Orthod.*, **41**, 674.
—, *et al.* (1951): 'Fact finding report on health services—orthodontics', *Amer. J. Orthod.*, **37**, 50.
—, and WEIN, S. L. (1952): 'Dental correlation in pituitary dwarfism', *Amer. J. Orthod.*, **38**, 674.
SARNAT, B. G.; BRODIE, A. G. and KUBACKI, W. H. (1954): 'A fourteen year report of facial growth in a case of complete anodontia with ectodermal dysplasia', *Amer. J. Orthod.*, **40**, 237.
SASSOUNI, V. (1955): 'A roentgenographic cephalometric analysis of cephalo-facio-dental relationships', *Amer. J. Orthod.*, **41**, 735.
SCHMITZ, W. (1955): 'Möglichkeiten und Grenzen der kieferorthopädischen Prophylaxe', *Deutsche Zahnärzt. Zahnheilk.*, **10**, 913.
SCHRÖDINGER, E. (1945): 'What is life', The Macmillan Co., New York.
SCHULZE, C. (1954): 'Über Anomalien menschlicher Eckzähne', *Stoma*, **7**, 25.
SCHWARZ, A. M. (1953): 'Lehrgang der Gebißregelung', Vol. 2., Vienna, Urban u Schwarzenberg.
—, (1955 a): 'Die 10 Gebote der Kieferorthopädie für den Zahnärzt', *Deutsche Zahnärztl. Zahnheilk.*, **12**, 917.
—, (1955 b): 'Wie der angehende Kieferorthopädie Gesicht und Schädel verstehen lernt', Vienna, Urban u. Schwarzenberg.

SCOTT, J. H. (1954): 'The growth and function of the muscles of mastication in relation to the development of the facial skeleton and the dentition', *Amer. J. Orthod.*, **40**, 429.
SELBACH, F. W. (1955): 'Über das Lutschen und Nägelbeisen', *Deutsche Zahnärztl. Zeitschr.*, **10**, 186.
SILLMAN, J. H. (1951): 'Thumb-sucking and the oral structures', *J. Pediat.*, **39**, 424.
SILVER, E. I. (1951): 'Ankylosed teeth', *Amer. J. Orthod.*, **37**, 28.
SOLEIL, J. (1953): 'Complications dentaires et osseuses après la radiothérapie', *Rev. Stomatol.*, **54**, 193.
STAFNE, E. C. (1952): 'Dental roentgenologic manifestations of systemic diseases', *Radiology*, **58**, 507.
STEINL, E. (1955): 'Ein Beitrag zur Retention des ersten und zweiten unteren Molaren', *Deutsche Zahnärztl. Zeitschr.*, **10**, 159.
STOLLER, A. E. (1954): 'The normal position of the maxillary first permanent molar', *Amer. J. Orthod.*, **40**, 259.
STRANDSKOV, H. H., and WASHBURN, S. L. (1951): 'Genetics and physical anthropology', *Amer. J. Phys. Anthropol.*, **9**, 261.
STRUSSER, H. and SIMON, L. A. (1954): 'Orthodontics in Public Health practice', *Amer. J. Orthod.*, **40**, 654.
SUBTELNY, J. D. and BRODIE, A. G. (1954): 'An analysis of orthodontic expansion in unilateral cleft lip and cleft palate patients', *Amer. J. Orthod.*, **40**, 686.
SULLIVAN, A. W. (1954): 'Modern concepts of thumbsucking', *N. Y. J. Med.*, **54**, 2474.
SUNDE, O. E. (1952): 'Forebyggelse ave plassmangel ved for tidlig tap ave temporaere tenner', *Den Norske Tann. Tid.*, **62**, 399.
SVED, A. (1954): 'A critical review of cephalometrics', *Amer. J. Orthod.*, **40**, 567.
TAGER, B. N. (1951): 'Endocrine problems in orthodontics', *Amer. J. Orthod.*, **37**, 867.
TOWNSEND, B. R. (1954): 'Some basic concepts in orthodontic', *Brit. Dent. J.*, **97**, 10.
TRAUSCH, G. S. (1955): 'A study of morphologic changes in the oral cavity induced by eccentric muscular activity in cerebral palsy children', *Amer. J. Orthod.*
TULLEY, W. J. (1952): 'The problem of etiology', *Trans. European Orthod. Soc. 198.*
—, (1953): 'Methods of recording patterns of behaviour of the oro-facial muscles using the electromyograph', *Trans. Brit. Soc. S. Orthod.*, 88.
WALLIS, H. R. E. (1953): 'Medical aspects of malocclusion', *Dent. Record*, **73**, 519.
WARKANY, J. and DEUSCHLE, F. M. (1955): 'Congenital malformation induced in rats by maternal riboflavin deficiency: dentofacial changes', *J. Amer. Dent. Ass.*, **51**, 139.
WATT, D. G. and WILLIAMS, C. H. M. (1951): 'The effects of the physical consistency of food on the growth and development of the mandible and the maxilla of the rat', *Amer. J. Orthod.*, **37**, 895.
WAUGH, L. M. (1955): 'Care of the deciduous teeth as the basis of occlusion of the permanent dentition', *Am. J. Orthod.*, **41**, 90.
WAUTIER, M. J. (1953): 'La Génétique et les Anomalies des Maxillaires et des Dents', *Ann. Odonto-Stomatol.*, **10**, 101.
WEDER, K. (1954): 'Erleichterte Therapie des Lippenlutschens', *Deutsche Zahn. Zeitschr.*, **14**, 798.
WEYERS, H. (1955): 'Über Wachstums- und Entwicklungsstörungen der Unterkiefersymphyse und ihre Begleitungsmißbildungen', *Stoma.*, **8**, 86.
WHITE, R. A. and SACKLER, A. M. (1954): 'Effect of progressive muscular dystrophy on occlusion', *J. Amer. Dent. Ass.*, **49**, 449.
WHITMAN, C. L. (1953): 'Simplifying our orthodontic problems', *Amer. J. Orthod.*, **39**, 571.
WILSON, H. E. (1954): 'A case showing the effect of radium therapy on developing tooth structures', *Brit. Dent. J.*, **95**, 82.

A STUDY OF THE FAMILY-LINE TRANSMISSION OF DENTAL OCCLUSION

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THE late Milo Hellman posed a serious problem when he stated that the influence of heredity, acknowledged by many authors in relation to orthodontics and challenged by others, had not been considered with a sufficient degree of accuracy, up to that time (1916), and still remained an enigma in so far as it related to the problem of malocclusion of the teeth. This work is, in a measure, an acceptance of the challenge and an attempt to add to the work begun by Dr. Wilton M. Krogman in a study of the influence of heredity upon the malocclusion of teeth via the family-line analysis approach.

It has been observed that the face, jaws, and teeth (size, position, and occlusion) of a person often resemble those of some other member or members of the family. Whether this may be said to be strictly hereditary is questionable. However, if an anomaly occurs in a family or in several branches thereof with some regularity, a genetic basis may be considered in the diagnosis of malocclusion. Since heredity may be an important factor in many forms of malocclusion, a project was undertaken to determine the genetic backgrounds in a series of cases of malocclusion in white boys, aged 9 to 14 years.

REVIEW OF THE LITERATURE

Historical.—The question of the inheritance of dentofacial characteristics has occupied the attention of dentists for more than a century. A review of the early literature reveals that as early as 1836 Friedrich G. Kniesel, in Germany, wrote that one of the causes of irregularity of the teeth was the "abnormal growth of the jaws, especially in the teeth progression; this is often transmitted from one generation to another." One of the earliest references to the often-heard principle of jaw-and-tooth inheritance, each from a separate parent, was expressed by Charles de Lourde, of England, who wrote in 1840 "Irregularity is due . . . to heredity, where the child inherits the jaws of one parent and the teeth of another."

With the rapid advancement of dentistry in this country, particularly after 1840, many of its leaders turned their attention to the problem of "irregularity of the teeth." Their opinions, as recorded in the literature of the day, were reflections of the writings of previous authors, foreign for the most part, and the results of their observations in private practice. Some authors gave detailed descriptions of various degrees of inheritance, such as "only

the incisors can be affected by heredity" (J. F. Flagg, 1859); "children resemble their mothers more than their fathers" (John S. Hough, 1873); and "as variations become more marked in offspring of affected parents, heredity transmitted the sum of these variations to the following generations" (S. Talbot, 1886).

McQuillen, in 1859, observed that the trait of contracted jaws, or the disproportion between superior and inferior maxillae running through families, passing from parents to children, was an interesting object of study. In 1859 C. A. Kingsbury, in his study of several families, most members of which exhibited high alveolar arches, concluded that this characteristic was transmitted through the maternal side. These various opinions were summed up in 1889 by S. H. Guilford in his book entitled *Orthodontia,* written at the request of the National Association of Dental Faculties, wherein the following conclusions were drawn:

(a) Only 10 per cent of cases of irregularity are due to inheritance.
(b) Heredity manifests itself by reproducing in the offspring characteristics of either parent of grandparent.
(c) "There would seem to be no valid reason why a child should not inherit the large teeth of one parent with the small jaw of the other, or vice versa."
(d) "Irregularity results more frequently from intermarriage of races."

At the beginning of the present century, when orthodontics became a separate specialty of dentistry, the problem of heredity as a possible etiological factor was more perplexing than ever. Opinions often were more conflicting than confirming. Within a few years a scientific approach to the problem began to take form in the early studies of pedigree histories of dental abnormalities by Thadani,[1] Baker,[2] Thomas,[3] Beadle,[3] and Huskins.[3] Yet the concept of family-line study was not to become established within the realm of scientific inquiry until the work of T. Wingate Todd.[4, 27] In 1935 he wrote that the most practical way to look at heredity today is not in the genealogies of feeble-mindedness or physical defect, but in the family growth pattern.[27] "Heredity today is a broad stream, and these formative influences inherent in our genes allow us plenty of latitude. Hence there are marginal members in most families, outsize or peculiar in gait, habit or attitude, persons to whom a double portion of inheritance has been allotted."[4]

References to the inheritance of anomalies in teeth and jaws in the dental, orthodontic, and scientific literature are numerous and varied. Statements by various authors differ in method of approach. It would be difficult, in analyzing these reports, to attempt to classify the thinking along these lines. For clarity and convenience, the following categories seem feasible: (1) characters of inheritance, (2) genetic independence of dentofacial complex, and (3) family-line survey.

1. *Characters of Inheritance.*—There are many explanations of the ways in which dentofacial characteristics may be inherited. Thadani[1] believed it to be a recessive, sex-linked gene; Ovazza[5] considered it a simple Mendelian dominant; and Iwagaki[37] maintained that, in the case of mandibular prognathism, it is probably a Mendelian recessive. Huskins[5] stated that the absence of incisors is a sex-linked recessive trait, whereas Schultz[6] identifies only "a hereditary tendency toward the elimination of the upper lateral incisor." Haldane[7] and Macklin,[8] in the case of defective enamel, proposed a sex-linked dominant. Hughes[9] emphatically stated, "We have no evidence of sex-linked or sex-influenced inheritance in the cranio-facial complex. Inheritance is autosomal." This opinion was stated similarly by Burks.[10] Weininger[11] contended that diastema is a result of a dominant gene and is possibly sex linked. In regard to opalescent dentine, Lyon[12] stated that the hereditary factor is dominant and not sex linked.

Krogman[13] pointed out the various hereditary influences upon the human craniofacial size and proportion and reviewed the work of various researches:

The length of the face: A dominant (Fischer) or dominant but modifiable (Todd).

The breadth of the face: Dominant for greater breadth (Lebzelter) or dominant but modifiable (Boas).

The height of the face: Dominant but modifiable (Boas).

Gonial breadth: Dominant for greater breadth (Lebzelter).

Chin: Dominant (Todd).

Progenia: Dominant (Fischer).

Upper lateral incisor: Suppressive recessive (Schultz).

Berger[14] quotes Hrdlicka as follows: "According to all indication, the normal heredity of the teeth and jaws is, aside from what is sex-linked, a blend heredity as that of many other and particularly epidermal features of the body, and not the simple Mendelian inheritance with its dominance, recessiveness and segregation." But Pryor,[15] in his study of normal variation in the ossification of bones, concluded that "the carpal sequence of ossification is a Mendelian character sometimes dominant and sometimes recessive; the gene concept applies to the osseous system with the same mathematical precision that it does to the rest of the organism." This is substantiated by the works of Vastine, Vastine, and Arango[16] and Reynolds.[17]

2. *Genetic Independence of Dentofacial Complex.*—Hughes[9, 18-20] stated categorically that the dentofacial complex is hereditarily independent of its parts; mandible and maxilla are independent; of the mandible, the ramus, body, angle, alveolus, and teeth are independent of each other, and the same is true of the maxilla. The parts of an organism are inherited and grow in terms of that inheritance. They have a position in the organism as a whole, and are related to one another in terms of heredity. Malocclusion is mainly an interpositional or configurational phenomenon.

Abel, referred to by Berger,[14] concluded that the size of the jaws and that of the teeth are inherited in a separate manner. In a study of thirty-five pairs of twins, Detlefsen[21] concluded that the tooth size and shape and arch size and shape are determined by heredity.

Moore[22] believed malocclusion to be an inheritable complex configuration, each part of the dentofacial complex having separate inheritance attributes: crowded anterior teeth, rotations, open-bite, and Angle's Class III malocclusion wherein the majority of cases have a hereditary deficient maxilla. In the case of asymmetrical facial features, the frequency is three- or fourfold in children whose parents showed similar facial asymmetry.

Rubbrecht[23] believed that the size and shape of the jaws and, in fact, mandibular prognathism and maxillary retrognathism depend upon hereditary variation. Macklin[24] contended that not only is malocclusion, per se, an inheritance characteristic, but that types of malocclusion are as well.

Lundstrom,[25] in his study of tooth size and occlusion in twins, concluded that "in extreme cases of malocclusion, heredity will be an important factor."

Others view the problem contrariwise. "Whereas heredity and recurring genetic influences are responsible for certain anthropological characters of the teeth and jaws, dento-facial development and occlusion are not transmissable hereditarily" (Abrahams[25]). Guyer[38] claimed that there is no evidence regarding inheritable types of facial disharmonies and that "there is a basis for the inheritance of disharmonies, and malformations, although unquestionably such plastic and active parts of the jaws are liable to pronounced modification by extrinsic factors."

Mention must be made of the important study of heredity by Stockard,[25] who conducted his experiments on dogs. In a special study of the skull, Johnson[26] found that, by cross-breeding dissimilar breeds, a highly modified skull resulted, the size of the teeth was independent of the jaw size, and the lengths of the maxilla and mandible were inherited independently. His belief was that differences in a person's response to similar experiences and stimuli could be attributed, to a great extent, to modifications of the secretions of the endocrine glands which, in their turn, were inherited characteristics.

3. *Family-Line Studies.*—As early as 1921, studies were being conducted to describe certain dental anomalies which are present in several generations of a family. The stimulating report of T. Wingate Todd[27] brought to the attention of the profession the value of the study of family line. His philosophy has been quoted above, but a further quotation is in order: "It is not always easy to refer vagaries in the pattern directly to the formative influence of heredity, but when one sees child after child of the same family showing the same peculiar features of the pattern differing only in the degree, not necessarily at the same age but always at the same stage of maturation . . . one must allow that some influence characteristic of that family inheritance is responsible."

Noteworthy of attention are the efforts of Korkhaus,[28] whose four-generation family line showed "the mandibular protrusion . . . the only orthodontic malformation of which inheritance can be claimed with a certain amount of justification." Anderson's[29] family line showing six generations added to Korkhaus' opinion. Bell[30] exhibited facial photographs of three generations in which he concluded that the restoration of masticatory function and facial symmetry may be accomplished up to the limit of inherited tendency. Downs[31] reported on the inheritability of Angle's Class II type of malocclusion.

Lebow and Sawin[32] present facial photographs of a pedigree of seven generations, noting particularly whether faces were long or round and prominence of ears, nose, and cleft chin. They concluded that, although long faces occur infrequently from round-faced parents and that long-faced persons produce both long-faced and round-faced progeny, the repeated appearance of the long face in successive generations cannot be from environmental factors alone, but is due to the "fortuitous recombination" of any great number of hereditary influences. Sawin,[33] after a family-line study of four generations, concluded that the genetic nature of physical variation can be approached from the pedigree analysis. Rubbrecht[23] presented family pedigrees of several cases, including the nine-generation Hapsburg family, by exhibiting photographs and charts of each. His conclusions corroborated the work of others in mandibular prognathism.

Stein, Kelley, and Wood[34] report that family pedigrees indicate that similar types of occlusion occur in families and that Angle's Class II occlusion may be due to recessive factors.

PRESENTATION

The propositi of this study were secured from patients of my private practice and patients of the orthodontic clinic, Children's Hospital, Philadelphia, Pennsylvania. No attempt was made at selection; rather, all the subjects were chosen from those who accepted an invitation to participate and cooperate in this project.

No further attempt was made in the selection regarding the subject's age, economic status, geographic location (only defined by the limits of practicability), social position, parental occupation, or even health and nutritional status.

A formal letter explaining the purposes and aims of this study was mailed to all patients appearing on the roster of the orthodontic clinic of the Children's Hospital and to interviewed patients from my private practice. They, with their families, were requested to become subjects for this project. Enclosed with each letter was a stamped, self-addressed envelope for their replies. As a result, the propositi represent a sampling of a small segment of the population of Philadelphia and environs within a 35-mile radius (including New Jersey).

Method.—Since it was not possible to secure impressions and to fabricate casts of the dentition of each subject, for financial reasons, it was decided to use photographs showing the face and teeth in occlusion. Each patient was

placed in a standing position with the face forward, head erect, and the teeth in an occluded position natural for the patient. The subject was then asked to hold cheek retractors on each side of the mouth to give as wide a view of the teeth as possible. With a commercial (Bolsey) camera designed for distant and close-up photography, a photograph was taken of the anterior view of the teeth in occlusion; another was taken of the right side; and a third was taken of the left side.

The patient removed the cheek retractors and assumed a natural pose. The full-face and profile photographs of the head were taken.

This procedure was repeated for every member of the family. In the case of deceased (or otherwise unavailable) members, exposures were made of their photographs which were supplied by the family. In the cases where no photographic evidence was available, the verbal description of the subject, elicited from a member of the family, was analyzed and catalogued. As a further check, all subjects were given an oral inspection with artificial light and tongue blade to confirm the diagnosis.

The photographs of each member of the family line were then mounted upon a master exhibit designed in the "family tree" method. From this, another chart was prepared in a similar manner in which each person's dental occlusion was identified by an appropriate symbol (Fig. 1). Although cases of deciduous dentition were charted, they did not become a part of the analysis.

Analysis.—In the analysis of the data, the terms "normal occlusion" and "malocclusion" will be used. Therefore, the following definitions are adopted: "Normal occlusion," as used in the classification in this study, is the relationship between the maxillary and mandibular arches in which the arches were symmetrically rounded and the posterior teeth interdigitated very regularly, taking the mesiobuccal cusp of the maxillary first molar occluding with the buccal groove of the mandibular first molar as the main point, and in which the maxillary anterior teeth either occluded edge-to-edge or overlapped up to one-half the length of the lower teeth. Some very small irregularities or mild rotations in single teeth were disregarded and these cases were included among those with normal occlusion. "Malocclusion," as used in the classification in this study, is based upon an intraoral method of Edward Angle (modified by M. Dewey and G. Anderson) .

The Angle classification of malocclusion has been used in this work because it is traditionally accepted and taught. However, as a result of a recent review[35] of the present researches on the problem of distoclusion, it has been pointed out that: "The cold scrutiny of science does not confirm many of the concepts of Class II, Division 1 malocclusions which had become a heritage of traditional teaching." The review points out that there are at least six possible morphologic variations in the dentofacial complex which may result in Class II, Division 1 malocclusion:

1. Maxillary bones and teeth anteriorly situated with relation to the cranium.
2. Maxillary teeth anteriorly placed in the maxillary bones.
3. Mandible underdeveloped.

4. Mandible of normal size but posteriorly placed.
5. Mandibular teeth posteriorly placed on adequate base.
6. Any combination of the above.

Fig. 1.—Symbolic representation of observations.

The clinical evaluation of fifty-nine cases of Class II, Division 1 and Class I, Type 2 malocclusions noted in these ten family lines indicates a common morphologic factor in both, namely, a procumbence of the upper anterior teeth. Bearing in mind the morphologic trait noted above in variation No. 2—"Maxillary teeth anteriorly placed in maxillary bones"—this evaluation ties

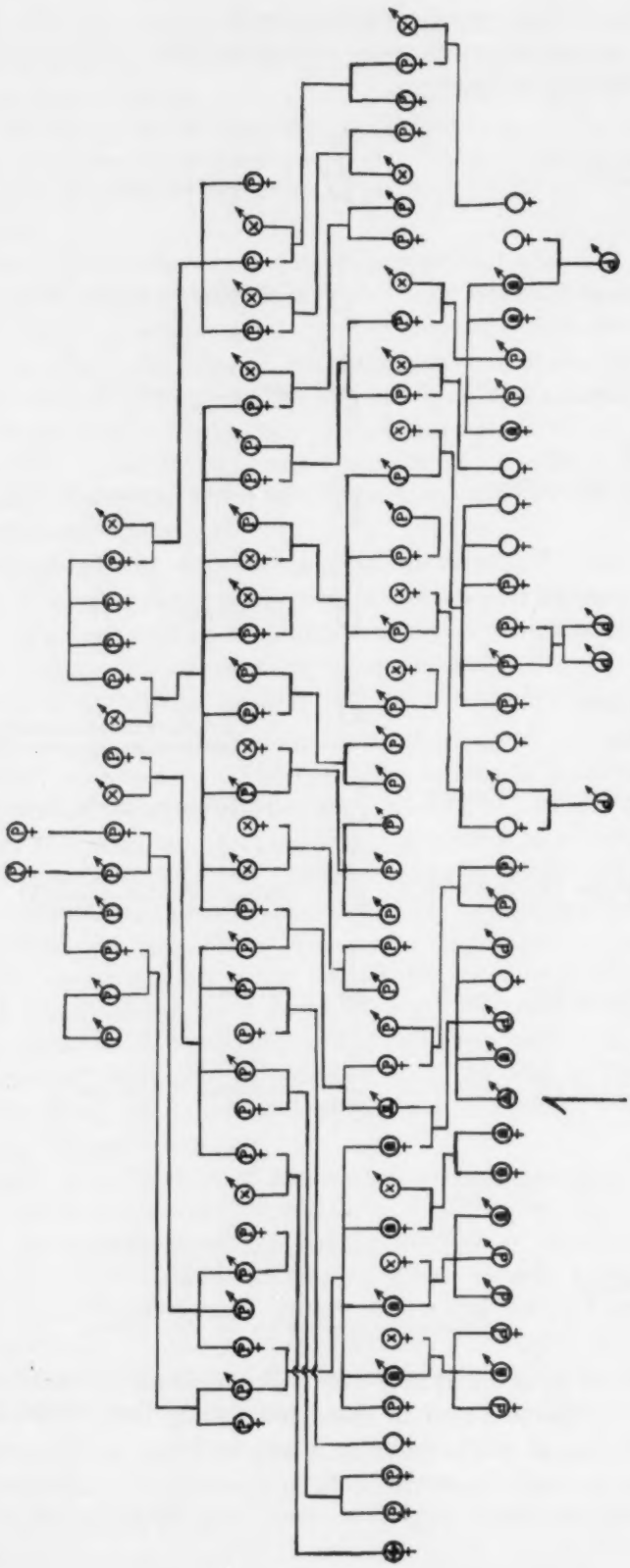

Fig. 2.—A. J. Case 1.

in with the observations of a narrowed bicanine width as a morphologic factor as well. It becomes evident that with a reduced bicanine dimension the anterior teeth become altered in position in several ways; namely, crowding (overlapping), rotations, and procumbency. All these characteristics are common to Class II, Division 1; Class I, Type 2; Class II, Division 2; and Class I, Type 1 malocclusions. If, for a moment, we dispense with the traditional grouping by Angle and bear in mind the results of the report by Fisk and colleagues[35] and the above observation, it would seem reasonable to assume that procumbency of the upper anterior teeth could be a morphologic trait independent of molar relationship in occlusion.

Fisk, in the review quoted previously, concluded that on the question of Class II, Division 2 and Class I malocclusions, "there is evidence to support the view that they both meet the same requirement." It is important to note that in this instance Class II, Division 2 and Class I, Type 1 exhibit a common morphologic trait, namely, crowding of the upper anterior teeth. This combination of malocclusions will be shown in only one family line of this series, that of Case 8, J. P. (Fig. 9).

Explanation of the Charts.—A table of symbols used in the preparation of the charts for ten family lines may be found in Fig. 1.

Case 1. A. J. (Fig. 2).—The propositus of this family line of six generations is a 10-year-old boy. He is one of five siblings, four male and one female. According to Dewey and Anderson's modification of Angle's classification, he presents a Class II, Division 1 malocclusion. One brother has a Class I, Type 2 malocclusion; the other two brothers have deciduous dentitions and the sister exhibits a normal occlusion. Within this generation there are twenty-seven cousins, both male and female. Of these, eight are identifiable by facial photographs only, six have deciduous dentitions, and eight have normal occlusions. Each of the other five cousins has a Class I, Type 2 malocclusion.

Observation of the boy's maternal inheritance indicates that the mother has a Class I, Type 2 malocclusion; the mother's two brothers have Class I, Type 2 malocclusions (the wife's occlusion is unknown in each case); and the mother's sister has a Class I, Type 2 malocclusion (the sister's husband's occlusion is unknown).

Observation of the boy's paternal inheritance indicates that the father has a Class I, Type 1 malocclusion; the father's sister's occlusion is unknown (her husband is represented by facial photographs only); and the father's cousin is represented by facial photograph only.

Comment: It should be noted that this family line comprises six generations of facial photographs, the analysis of which is not germane to this thesis.

We have noted the marked similarity in Class I, Type 2 and Class II, Division 1 malocclusions and the admonition of Todd in reference to continual recurrence of a trait within a family group. Therefore, it may be concluded that the propositus falls within a hereditary (maternal) background of the procumbency of the maxillary anterior teeth.

Case 2, R. A. (Fig. 3).—The propositus in this family line of four generations is a 12-year-old boy. He is one of two siblings, the other being a girl. He presents a Class II, Division 1 malocclusion. His sister has a normal occlusion, with the exception of a diastema between the maxillary central incisors.

Observation of the boy's maternal inheritance indicates that the mother has a Class III, Type 2 malocclusion and the mother's brothers (two) and sisters (two) are represented by facial photographs only or are unknown.

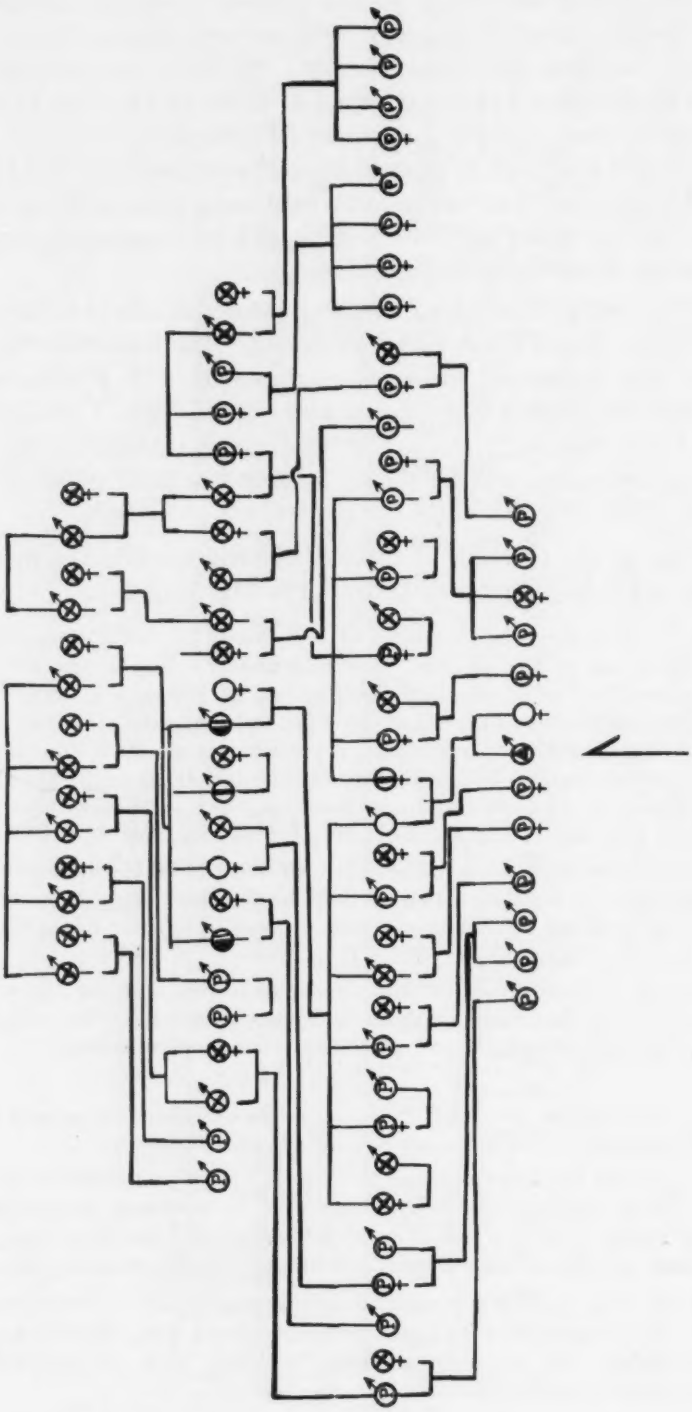

Fig. 3.—R. A. Case 2.

Observation of the boy's paternal inheritance indicates that the father is normal and the father's three brothers and two sisters are represented by facial photographs only or are unknown.

Observation of the boy's grandparental inheritance (paternal) indicates that the father's parents are unknown; the father's uncle has a Class III, Type 1 malocclusion; the father's aunt is normal; the father's second uncle has a Class III, Type 2 malocclusion; and other members of this generation are unknown.

Observation of the boy's great-grandparental inheritance (maternal) indicates that the mother's grandparents are represented by facial photographs only or are unknown.

Comment: There is exhibited in this family line a phenomenon which is to be found in another analysis in the series, a type of malocclusion found in one generation which may or may not be present in the following generation, but which is completely absent in the third generation. In the paternal grandparental generation there is found a predominant malocclusion of the Class III type but, due to some shift or possible gene recombination, no such type is found in the generation of the propositus; rather, there is malocclusion of an entirely different sort, namely, Class II.

Case 3. W. R. (Fig. 4).—The propositus in this family line is a boy, aged 10 years. He is one of two siblings, the other being a girl. He presents a Class II, Division 1 malocclusion. Within this generation there are fourteen cousins, of whom four are eliminated because of deciduous dentition. Of the remaining ten, eight are normal. One has a Class I, Type 1 malocclusion. The tenth has a Class II, Division 1, subdivision, malocclusion.

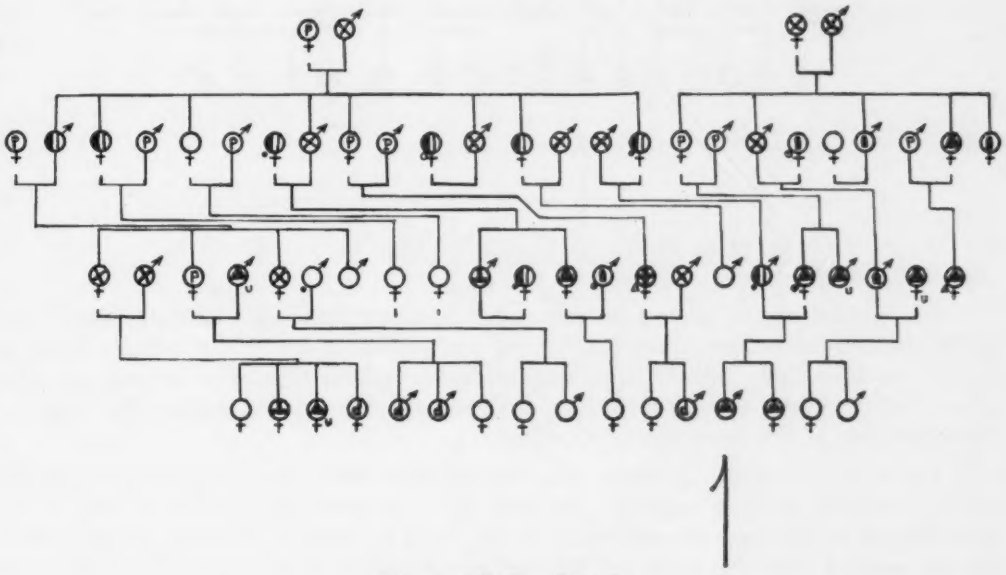

Fig. 4.—W. R. Case 3.

Observation of the boy's maternal inheritance indicates that the mother has a Class II, Division 1, malocclusion with a posterior (molar and premolar) cross-bite; the mother's brother has a Class II, Division 1, subdivision, malocclusion; the mother's male cousin has a Class I, Type 2 malocclusion; and the mother's female cousin has a Class II, Division 1 malocclusion with an anterior open-bite.

Observation of the boy's paternal inheritance indicates that the father has a Class III, Type 1 malocclusion with a posterior cross-bite; the father has one female cousin who has a Class IV malocclusion with an anterior open bite; one female cousin with a Class II,

Division 1 malocclusion; one female cousin with a Class I, Type 1 malocclusion; two female cousins who are unknown, except by facial photographs; two female cousins who are normal; and two male cousins who are normal.

Observation of the boy's grandparental inheritance (maternal) indicates that the mother has an aunt who is normal; an aunt with a Class II, Division 1 mlocclusion; and an aunt with Class I, Type 2 malocclusion. The mother has an uncle with a Class I, Type 2 malocclusion, and another uncle is unknown. Other members of this generation are unknown, or are represented by facial photographs only.

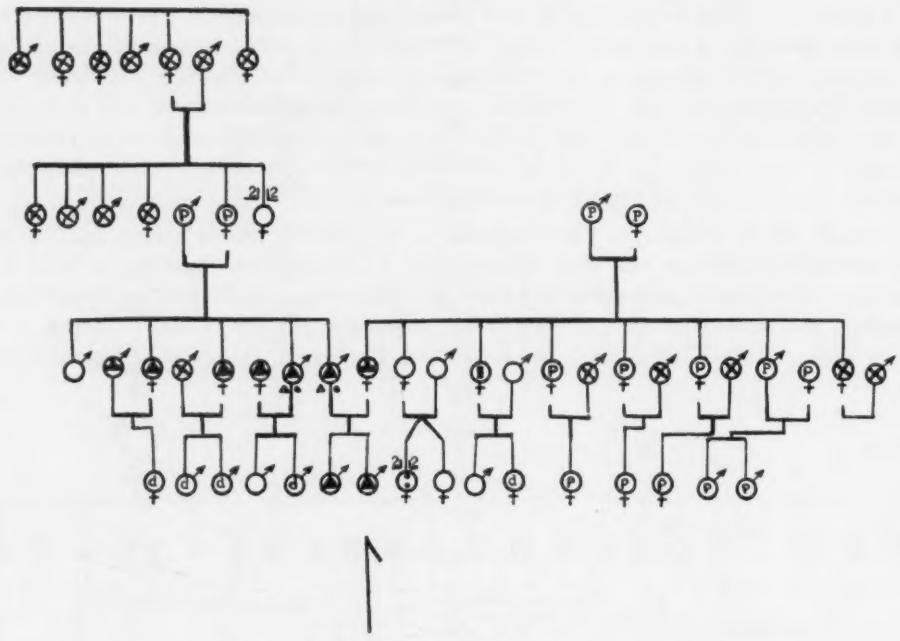

Fig. 5.—R. B. Case 4.

Observation of the boy's grandparental inheritance (paternal) indicates that three of the father's aunts have Class III, Type 1 malocclusions; one of the father's aunts is normal; another of the father's aunts is unknown, except for facial photographs; and two of the father's uncles are unknown (one of these unknowns married a Class III, Type 1). Other members of this generation are unknown.

Comment: Within this family line are combined all the forces operative as stated in the foregoing detailed analysis. We note that the maternal side carries with it the procumbency of the upper anterior teeth through three generations, down to the propositus. On the paternal side, the shift (or possible gene recombination) phenomenon is evident wherein a Class III, Type 1 malocclusion is observed in the grandparental generation, followed in the next generation by a continuance of it, but with the addition of the Class II, Division 1 malocclusion, and finally, in the generation of the propositus, either normal dentition or Class II, Division 1 malocclusion.

The complete absence of Class III malocclusion in the generation of the propositus should be noted. The propositus, in this instance, had the double effect of the recurrence of a procumbency of the upper anterior teeth within the maternal family and the clinically understandable "shift effect" on the paternal side accruing to his hereditary endowment.

Case 4, R. B. (Fig. 5).—The propositus in this family line of four generations is a 12-year-old boy. He is one of two siblings, both of whom exhibit Class II, Division 1 malocclusion.

Observation of the boy's maternal inheritance indicates that the mother has a Class I, Type 1 malocclusion; one of the mother's sisters has a Class I, Type 2 malocclusion; another sister is normal, and four of the mother's sisters are unknown or are represented by facial photographs only. The mother's brother is identifiable by facial photographs only.

Observation of the boy's paternal inheritance indicates that the father has a Class II, Division 1 malocclusion with a posterior cross-bite and anterior open-bite; one of the father's brothers is normal; two brothers have Class II, Division 1 malocclusions; and another brother has a Class II, Division 1 malocclusion with a posterior cross-bite and anterior open-bite.

Observation of the boy's grandparental inheritance (maternal) indicates that the mother's parents are unknown or are identifiable only by facial photographs. Other members of this generation are unknown, or are identifiable by facial photographs only.

Observation of the boy's grandparental inheritance (paternal) indicates that the Father's aunt has congenitally missing upper lateral incisors. Other members of this generation are unknown, or are identifiable by facial photographs only.

Comment: The dominant feature of this family line is the strong Class II, Division 1 malocclusion manifested within the paternal family. The fact that the cousins of the propositus are either of deciduous dentition or are unknown is regrettably unavoidable.

Although there are congenitally missing incisors in a paternal grandaunt, it is interesting to note that there is no recurrence in succeeding generations. Curiously enough, this same defect is noted in a maternal cousin of the propositus, who is the child of normal parents and grandparents.

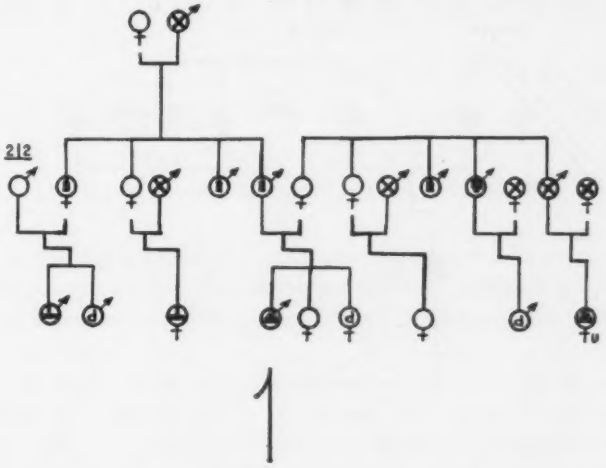

Fig. 6.—T. R. Case 5.

Case 5, T. R. (Fig. 6).—The propositus in this family line of three generations is a 9-year-old boy. He is one of three siblings. He presents a Class II, Division 1 malocclusion. One sister is normal. One sister will not be considered because of deciduous dentition. Within this generation are six cousins. Two cousins have deciduous dentition; two have Class I, Type 1 malocclusions; one cousin is normal; and the sixth has a Class II, Division 1, subdivision, malocclusion.

Observation of the boy's maternal inheritance indicates that the mother is normal; one of the mother's sisters is unknown; another sister is normal; one brother has a Class I, Type 2 malocclusion; and one brother has a Class I, Type 5 malocclusion.

Observation of the boy's paternal inheritance indicates that the father has a Class I, Type 2 malocclusion; one of the father's brothers is unknown; another brother has a Class I, Type 2 malocclusion; and the father's sister has Class I, Type 2 malocclusion.

Observation of the boy's grandparental inheritance (maternal) indicates that the members of this generation are either unknown or are identifiable by facial photographs only.

Observation of the boy's grandparental inheritance (paternal) indicates that the father's mother is normal; other members of this generation are unknown, or are identifiable by facial photographs only.

Comment: The predominating influence of the procumbency of the upper anterior teeth is exhibited through two generations. Class I, Type 2 malocclusions are found in both the maternal and paternal families of the propositus. A greater proportion of persons with this type of malocclusion than any other, or even with normal occlusion, is noted. The propositus exhibits this same morphologic trait, but with a distoclusion of the molar relationships.

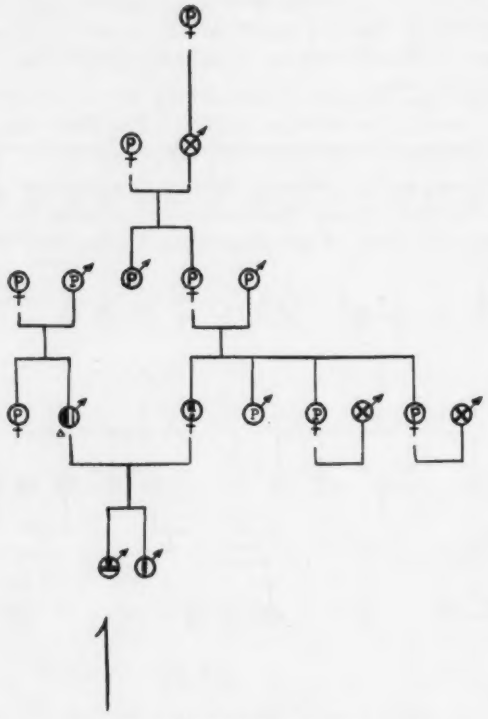

Fig. 7.—P. D. Case 6.

Case 6, P. D. (Fig. 7).—The propositus of this family line of five generations is a boy, aged 11 years. He is one of two siblings. He presents a Class I, Type 1 malocclusion; his brother's is a Class I, Type 2. There are no cousins.

Observation of the boy's maternal inheritance indicates that the mother has a Class I, Type 5 malocclusion; the mother's brother and two sisters are represented by facial photographs only.

Observation of the boy's paternal inheritance indicates that the father has a Class III, Type 1 malocclusion with an anterior open-bite; the father's brother is represented by facial photograph only.

The grandparental, great-grandparental, and great-great-grandparental generations are represented by facial photographs only.

Comment: Contact was possible with only the immediate members of the propositus' family. Facial photographs of the others in the family line were available. Both children are within the Class I type of malocclusion. The mother's malocclusion is also of this type. The father has Class III malocclusion, but neither child exhibits this tendency. We note a shift within two generations, as compared with previous cases where the shift in type of malocclusion occurred in three generations.

Case 7, J. A. (Fig. 8).—The propositus of this family line of four generations is a boy, 10 years old. He is one of four siblings. His is a Class II, Division 1 malocclusion. One brother has Class II, Division 1 malocclusion; one brother has deciduous dentition; and one sister is normal. Within this generation are sixteen cousins. Five have deciduous dentitions; six are normal (one exhibits absent deciduous upper lateral incisors); four cousins have Class II, Division 1 malocclusions; one has a Class I, Type 1 malocclusion; and the remaining two have Class II, Division 2 malocclusions.

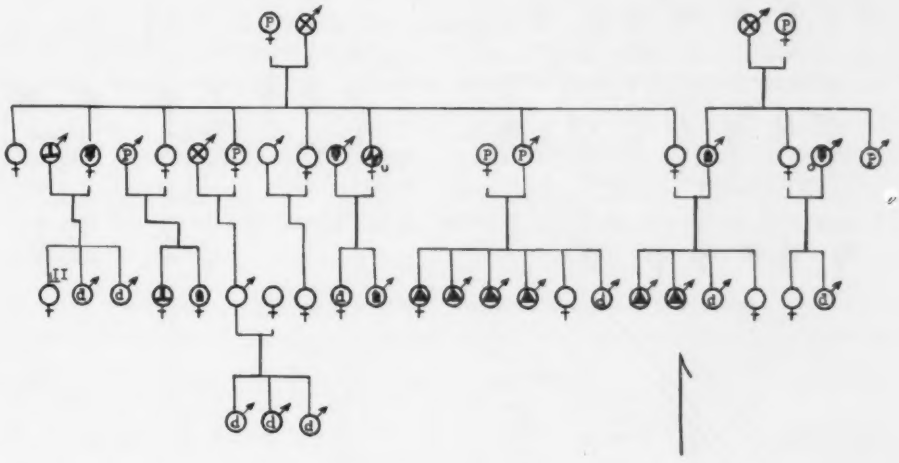

Fig. 8.—J. A. Case 7.

Observation of the boy's maternal inheritance indicates that the mother is normal; three of the mother's sisters are normal; one sister has a Class I, Type 5 malocclusion; one sister has a Class I, Type 4 malocclusion; and the mother's brother is represented by facial photographs only.

Observation of the boy's paternal inheritance indicates the father has a Class I, Type 2 malocclusion; the father's sister is normal (her husband is represented by facial photographs only); and the father's brother is represented by facial photographs only.

The members of the grandparental generation are either unknown or are represented by facial photographs only.

Comment: The striking feature of this family line is the predominance of Class II, Division 1 malocclusion in the siblings. Four of the diagnosable cases are concerned. Almost one-half the generation have Class II, Division 1 malocclusions. If we add to them the cases of Class I, Type 2 malocclusion (within the framework of our concept of morphologic traits), more than 50 per cent of these children exhibit the same basic type of malocclusion. Unfortunately, the parents of the propositus could not be diagnosed accurately. Within their generation, however, six of the twelve diagnosable cases are within Class I; only one of these is a Class I, Type 2. A tying-in of Class I, Type 2 and Class II, Division 1 is discernible in only one family.

We have, in this family line, another type of shift within two generations, namely, from Class I to Class II. The cause or causes of this phenomenon are, as yet, undetermined. The predominance of Class II, Division 1 malocclusion might indicate some undisclosed inheritable trait within this family line.

A curious deviation is the case of absent deciduous lateral incisors with no apparent inheritable factor.

Case 8, J. P. (Fig. 9).—The propositus of this family line of four generations is a 14-year-old boy. He is one of a pair of twins, and is one of three siblings. His is a Class II, Division 1 malocclusion. Both his twin and other sister have Class II, Division 1 malocclusions. There are three cousins, two with deciduous dentitions and one with a Class II, Division 2 malocclusion.

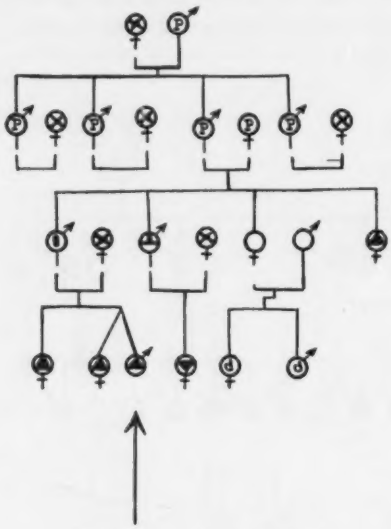

Fig. 9.—J. P. Case 8.

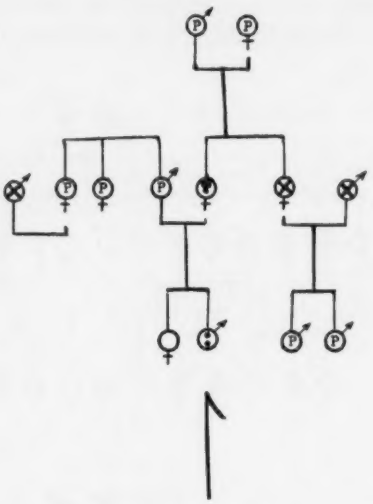

Fig. 10.—J. D. Case 10.

Observation of the maternal generation revealed all members of this group to be unknown or not available.

Observation of the boy's paternal inheritance indicates that the father has a Class I, Type 2 malocclusion; the father's brother has a Class I, Type 1 malocclusion; one of the father's sisters is normal; and another sister has a Class II, Division 1 malocclusion.

The boy's maternal grandparents are unknown or unavailable.

The boy's paternal grandparents are represented by facial photographs only.

The boy's great-grandparental generation (paternal) is represented by facial photographs only.

Comment: The propositus exhibits, with his twin sister, a Class II, Division I malocclusion. When we refer again to our reclassification, we note a 50 per cent appearance of this trait in the paternal generation. (I was unable to secure any cooperation from the mother of this child.)

Curiously enough, this family line is the only one in which a case of Class II, Division 2 malocclusion appears. However, the hereditary endowment seems to fulfill the opinion of Fisk (referred to earlier).[35] The father of this child has a Class I, Type 2 malocclusion, in which the characteristic trait is a procumbency of the upper anterior teeth, This same morphologic trait is exhibited in the case of Class II, Division 1 malocclusion.

It would seem that the propositus has received his fair endowment of the inheritable morphologic trait, namely, procumbency of the upper anterior teeth.

Case 9, J. R.—The propositus of this two-generation family line is a 9-year-old boy. He is one of three siblings. His is a Class II, Division 1 malocclusion. One brother is normal and one has deciduous dentition.

Within the parental generation, the father is found to be normal; the mother is found to have a Class II, Division 1, subdivision, malocclusion.

Comment: No cooperation was forthcoming from the relatives of this family. Since the number of antecedents is limited, it can only be said that whatever inheritable characteristics are shown by the propositus seem to have been derived from the maternal side. No pedigree is given here.

Case 10, J. D. (Fig. 10).—The propositus of this three-generation family line is a boy, 11 years old. His is a Class I, Type 3 malocclusion. His sister exhibits a normal occlusion. His two cousins have deciduous dentitions, and are represented by facial photographs only.

Observation of the boy's maternal inheritance indicates that the mother has a Class I, Type 5 malocclusion; other members of this generation are unknown.

Observation of the boy's paternal inheritance indicates that the father is represented by facial photographs only; the father's two sisters are represented by facial photographs only; other members of this generation are unknown.

The grandparental generation (maternal) is represented by facial photographs only.

Comment: This family line is also meager in its representation due to poor cooperation on the part of relatives of the family. It can only be stated that whatever inheritable characteristics are exhibited by the propositus could have been received through the maternal side.

Table I shows the distribution, by family units, of the ten cases just presented. There were 122 family units, including 357 members. There is represented an average family unit of 3.33 persons, over an average of 3.9 generations.

TABLE I. DISTRIBUTION OF SUBJECTS BY FAMILY UNITS*

CASE NUMBER	PATIENT	FAMILY UNIT	TOTAL MEMBERS	M/FU†	GENERATIONS
1	A. J.	33	104	3.3	6
2	R. A.	25	49	2.0	4
3	W. R.	19	56	3.0	4
4	R. B.	13	38	3.2	4
5	T. R.	7	19	2.7	3
6	P. D.	5	15	3.0	5
7	J. A.	11	44	4.4	4
8	J. P.	5	17	3.5	4
9	J. R.	1	5	5.0	2
10	J. D.	3	10	3.3	3
		122	357	33.3	3.9

*A family unit is defined as parents plus children, in each generation.
†M/FU equals total members divided by number of family units.

Table II presents the breakdown, by normal occlusion and classes and types of malocclusion, for the foregoing ten cases.

TABLE II. DISTRIBUTION OF SUBJECTS PERSONALLY OBSERVED BY TYPES OF NORMAL AND ABNORMAL OCCLUSION

	I					II		III			IV	N*	d†	TOTAL
	1	2	3	4	5	1	2	1	2	3				
M	7	15	0	0	3	17	0	6	1	0	0	19	26	94
F	4	12	1	2	3	15	1	7	0	0	1	38	8	92
Totals	11	27	1	2	6	32	1	13	1	0	1	57	34	186
%	5.9	14.97	0.1	0.2	3.2	17.2	0.1	6.9	0.1	0	0.1	30.58	18.28	

*N = Normal dentition.
†d = Deciduous dentition.

There are ninety-five cases of malocclusion, representing 62.5 per cent, and fifty-seven cases of normal occlusion, representing 37.5 per cent of the total number of nondeciduous dentitions.

SUMMARY AND CONCLUSION

1. This article presents family-line studies of ten boys, aged 9 to 14 years, selected at random, who had some type of malocclusion. An analysis was made of each family line in which the occlusal and facial characteristics of all available members were noted by means of inspection, recorded by photographs, and symbolically represented by use of genealogic charts.

2. A review of the literature is presented, stressing a historical survey, characters of inheritance, genetic independence within the dentofacial complex, and the method of family-line analysis.

3. The review of hereditary characters in human beings does not lend itself to an orderly analysis, as is possible in animals or plants. Mendelian ratios cannot be observed; even phenotypically similar families give inaccurate ratios because, although the phenotypes are similar, the genotypes may be different. It is almost impossible to identify a genotype in the human being by inspection. Snyder[36] states: "Pedigrees must always remain the basis of the study of human heredity."

4. The result of these family-line studies of malocclusion in boys seems to indicate the following hypotheses:

(a) Occlusion (malocclusion) may be represented by the interdependence of various morphologic traits. For example, in the case of a reduced bicanine width there is manifested an alteration in the position of anterior teeth, namely, crowding, rotation, or procumbency. Since these characteristics are, in part, descriptive of both Class I and Class II (Angle) malocclusions, there is reason to believe that each could be a morphologic trait independent of, but related to, molar relationships.

(b) Three types of transmission may be noted, which are as follows:

(1) *Repetitive trait:* This type of transmission is characterized by the recurrence of a single morphologic trait within the family line over several generations. This indicates a hereditary endowment arising within either the maternal or the paternal side, or both. Examples may be found in Cases 1, 4, 5, 8, and 9.

In Case 1, the propositus has a Class II, Division 1 malocclusion and the family-line occlusion is basically a Class I, Type 2.

In Case 4, the propositus has a Class II, Division 1 malocclusion and the family line is a Class I, Type 1 and Type 2, in addition to Class II, Division 1 on the paternal side.

In Case 5, the propositus has a Class II, Division 1 malocclusion and the family line is a Class I, Type 1 and Type 2. (There is a Class I, Type 5 malocclusion which probably is not hereditary.)

In Case 8, the propositus has a Class II, Division 1 malocclusion and the family line is Class I, Type 1 and Type 2.

In Case 9, the propositus has a Class II, Division 1 malocclusion and the family line is Class II, Division 1.

(2) *Discontinuous or assortative trait:* This type of transmission is characterized by the recurrence of a single morphologic trait within the family line over several generations. This indicates a hereditary endowment arising in either the maternal side or the paternal side, plus the shift or possible gene recombination within the family line of the opposite sex. Examples may be found in Cases 2, 3, and 7.

In Case 2, the propositus has a Class II, Division 1 malocclusion and the family line is basically Class III.

In Case 3, the propositus has a Class II, Division 1 malocclusion and the family line is Class II, Division 1, Class I, Type 2, and Class III, wherein the maternal side is characterized by the Class I, Type 2.

In Case 7, the propositus has a Class II, Division 1 malocclusion and the family line is Class II, Division 1 in the siblings and Class I, Type 2 in the parental and grandparental generations.

(3) *Mixed trait:* This type of transmission is characterized by different morphologic traits within either family line of several generations; different types occur from generation to generation. An example of this may be found in Case 6.

In Case 6, the propositus has a Class I, Type 1 malocclusion and the family line is mixed, that is, the maternal side is predominately Class I and the paternal side is predominately Class III.

5. The adoption of the family-line procedure, with the recording of the history of many dentofacial deviations, will lead to a basis for a fuller understanding and/or anticipation of a given case of malocclusion. With it, the orthodontist has added another instrument to his armamentarium for a more thorough approach to orthodontic analysis and treatment.

6. It still remains for the orthodontist, with the mechanical means available, to treat malocclusions; but he should recognize and adapt the added knowledge by a survey of any possible hereditary endowments. It behooves him to place *each patient* in a familial framework in order that he may evaluate the possibility and potentiality of genetically determined or conditioned harmonious or unharmonious dentofacial development.

REFERENCES

1. Thadani, K. K.: A Toothless Type of Man, J. Hered. **12**: 87, 1921.
2. Baker, Charles R.: Similarity of Malocclusion in Families, INT. J. ORTHODONTIA **10**: 459, 1924.
3. Simer, Parke H.: Heredity and Transmission, J. Am. Dent. A. **21**: 844, 1934.
4. Todd, T. W.: Hereditary and Environmental Factors in Facial Development, INT. J. ORTHODONTIA **18**: 799, 1932.
5. Clark, F. H., and Clark, C. S.: Absence of Tooth Enamel, J. Hered. **24**: 425, 1933.
6. Schultz, Adolph H.: The Hereditary Tendency to Eliminate the Upper Lateral Incisors, Human Biol. **4**: 34, 1932.
7. Haldane, J. B. S.: A Probable New Sex-Linked Dominant in Man, J. Hered. **28**: 58, 1937.
8. Macklin, M. T.: Absent Tooth Enamel, Eugenical News **23**: 28, 1938.
9. Hughes, Byron O.: Heredity as a Factor in Cranial and Facial Development, AM. J. ORTHODONTICS AND ORAL SURG. **28**: 357, 1942.
10. Burks, Barbara S.: Elucidation of the Transmission Mechanism of a Hereditary Defect in Man Through Linkage Relationships of a Normal Trait, Eugenical News **23**: 70, 1938.
11. Weininger, Margarete: The Inheritance of Widely-spaced Incisors, Ztschr. Morphol. u. Anthropol. **32**: 367, 1953.
12. Lyon, Don C.: Evidence of the Hereditary Factor in Opalescent Dentin, J. Am. Dent. A. **27**: 1281, 1940.
13. Krogman, Wilton M.: The Inheritance of Non-pathologic Physical Traits in Man, Eugenical News **21**: 139, 1936.
14. Berger, H.: Constitution, Heredity and Orthodontia, AM. J. ORTHODONTICS AND ORAL SURG. **24**: 136, 1938.
15. Pryor, J. W.: Normal Variation in the Ossification of Bones, Due to Genetic Factors, J. Hered. **30**: 249, 1939.
16. Vastine, Jacob H., II, Vastine, Mary F., and Arango, Oriol: Genetic Influence on Osseous Development With Particular Reference to the Deposition of Calcium Intercostal Cartilages, Am. J. Roentgenol. **59**: 213, 1948.
17. Reynolds, Earle L.: Degree of Kinship and Pattern of Ossification, Am. J. Phys. Anthropol. **1**: 405, 1943.
18. Hughes, Byron O.: Heredity and Variation in the Dento-Facial Complex, AM. J. ORTHODONTICS AND ORAL SURG. **30**: 543, 1944.
19. Hughes, Byron O.: Race, Growth and Occlusion, AM. J. ORTHODONTICS AND ORAL SURG. **24**: 1065, 1938.
20. Hughes, Byron O., and Moore, George R.: Heredity, Growth and the Dento-Facial Complex, Angle Orthodontist **11**: 217, 1941.
21. Detlefsen, J. A.: Intrinsic or Hereditary Factors Versus Extrinsic or Environmental Factors in the Determination of Tooth and Oral Peculiarities, J. D. Res. **8**: 419, 1928.
22. Moore, George R.: Heredity as a Guide in Dento-facial Orthopedics, AM. J. ORTHODONTICS AND ORAL SURG. **30**: 549, 1944.
23. Rubbrecht, O.: A Study of the Heredity of the Anomalies of the Jaws, AM. J. ORTHODONTICS AND ORAL SURG. **25**: 751, 1939.
24. Macklin, M. T.: Role of Heredity in Disease, Medicine **14**: 1, 1935.
25. Krogman, Wilton M.: How Does Genetics Fit Into the Orthodontic Picture? (Abstract), AM. J. ORTHODONTICS **38**: 138, 1952.
26. Johnson, A. LeRoy: Studies in Genetics of Interest to the Orthodontist, INT. J. ORTHODONTIA **19**: 273, 1933.
27. Todd, T. W.: The Bodily Expression of Human Growth and Welfare, Science **82**: 181, 1935.
28. Korkhaus, G.: Investigations Into the Inheritance of Orthodontic Malformations, INT. J. ORTHODONTIA **17**: 251, 1931.
29. Anderson, Bert G.: Hereditary Malocclusion, Yale J. Biol. & Med. **16**: 245, 1944.
30. Bell, Brooks: A Case Report on the Hereditary Factor in Three Cases of Mesioclusion, AM. J. ORTHODONTICS AND ORAL SURG. **25**: 1079, 1939.
31. Downs, W. G.: Studies in Causes of Dental Anomalies, J. D. Res. **8**: 367, 1928.
32. Lebow, M. R., and Sawin, P. B.: Inheritance of Human Facial Features, J. Hered. **32**: 127, 1941.
33. Sawin, Paul B.: Application of the Principles of Heredity to Orthodontics, AM. J. ORTHODONTICS AND ORAL SURG. **25**: 401, 1939.
34. Stein, Kathryn F., Kelley, Thomas J., and Wood, Eunice: Influence of Heredity in the Etiology of Malocclusion, AM. J. ORTHODONTICS **42**: 125, 1956.

35. Fisk, G. V., Culbert, M. R., Grainger, R. M., Hemrend, B., and Moyers, R.: The Morphology and Physiology of Distoclusion, AM. J. ORTHODONTICS **39**: 3, 1953.
36. Snyder, Lawrence H.: The Principles of Heredity, ed. 2, Boston, 1940, D. C. Heath & Co., p. 413.
37. Iwagaki, H.: Hereditary Influence of Malocclusion: Statistical Studies of the Heredity of Progenia, AM. J. ORTHODONTICS AND ORAL SURG. **24**: 328, 1938.
38. Guyer, M. F.: Abnormalities of Teeth and Jaws From the Standpoint of Inheritance, INT. J. ORTHODONTIA **10**: 323, 1924.

25 HADDON AVE.

AN APPRAISAL OF TWO RELATIONSHIPS PROPOSED FOR USE IN ORTHODONTIC DIAGNOSIS

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IN A paper presented at the 1955 meetings of the European Orthodontic Society, Berger[3] recommended wider use of two diagnostic aids which he has employed in clinical practice. One of these aids is the bizygomatic-bimolar relationship which he first proposed in 1926[2]; the other is a relationship between bizygomatic face width and width of the permanent maxillary incisors.

The common dimension in both relationships is bizygomatic face width. Berger[3] regards bizygomatic diameter as an "extremely sensitive measurement" for determining (1) the "constitutionally" correct width of the maxillary dental arch in the region of the permanent first molars and (2) the adequacy of the amount of "maxillary base" available for a patient's mixed and permanent dentitions.

BIZYGOMATIC WIDTH AND COMPOSITE WIDTH OF THE MAXILLARY INCISORS

Berger's 1955 paper[3] includes a chart for evaluating the adequacy of the maxillary base. In using this chart, the orthodontist enters, along its vertical scale, the bizygomatic diameter of the patient and, along its horizontal scale, the sum of the mesiodistal diameters of his four permanent maxillary incisors. The chart is diagnostic in that it is partitioned into zones designated "lack of space," "harmony," and "excess of space." The major interpretation made is that for those patients falling in the "lack of space zone," the only solution for successful treatment is "extraction . . . a reduction of tooth material." The chart is described solely as a clinical tool; there is no accompanying reference to research findings on the relationship between bizygomatic face width and composite width of the permanent maxillary incisors.

Since, as Berger emphasizes, utilization of the bizygomatic-incisor relationship "becomes possible at a relatively early age," we were interested in appraising its usefulness in North American orthodontic practice around the time when active eruption of the permanent maxillary incisors is completed. The age selected for investigation was 11 years.

The subjects were 100 North American white children, forty-seven boys and fifty-three girls, residing in or near Iowa City, Iowa. All were voluntary participants in the Facial Growth Study, a long-term research program at the

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State University of Iowa sponsored jointly by the Department of Orthodontics and the Child Welfare Research Station. Enrollment in the study was based on likelihood of continuing residence in the community and willingness to participate; there was no selection with reference to dental condition or orthodontic need.

With regard to ethnic background, the children are predominantly of northwest European ancestry. Socioeconomically, the sample is heavily weighted with children of above-average status.[5]

Bizygomatic diameter was determined by direct measurement. The tips of spreading anthropometric calipers were placed against the sides of the face at numerous points along the lateral surfaces of the zygomatic arches; the anthropometrist applied firm pressure and carefully sought the greatest bizygomatic width. Separate measurements were always taken by two anthropometrists. When these differed by 1.0 mm. or less, their mean was accepted as the final record. In instances of greater discrepancy, each anthropometrist made a second measurement and the mean of the four determinations constituted the final record.[7]

The sum of the mesiodistal diameters of the four permanent maxillary incisors was obtained from dental stone casts. Using sliding vernier calipers, and reading to the nearest 0.1 mm., two trained anthropometrists independently measured the maximum mesiodistal diameter of each permanent incisor. In instances where the two records agreed within 0.2 mm., the average of the two was used. In instances where the difference exceeded 0.2 mm., two additional independent measures were obtained and the average of the four was used.

Both sets of data represented the age of 11 years; the dental impressions and bizygomatic measurements were taken within a few days of each child's eleventh birthday.

The first step in analysis was that of plotting the data for children of each sex on a bizygomatic-incisor chart.* In terms of Berger's classification categories,[3] it was found that the 100 maxillary dental arches were distributed as follows: "lack of space," 31; "harmony," 53; "excess of space," 16.

Next, the clinical adequacy of these classifications was tested against independent classifications made by an orthodontist (E. H. H.) from direct examination of the dental casts. Cast examination showed that in twenty-two of the 100 maxillary dental arches there was insufficient space, and in ten there was some excess space.

Of the twenty-two children lacking in adequate maxillary space, only eight fell within Berger's bizygomatic-incisor "zone of lack of space." Thirteen of the twenty-two were in his "harmony zone," and one was in the "zone of excess." Similarly, the ten arches orthodontically classed as having an excess of space were scattered across the bizygomatic-incisor zones ("excess of space," 5; "harmony," 2; "lack of space," 3).

*From these charts it was possible to comput Pearson r correlation coefficients. The coefficients obtained were 0.20 on boys and 0.32 on girls. These values are reported as by-product findings of interest to students of faciodental relationships; they are not of direct relevance in appraising Berger's use of the charts in orthodontic diagnosis.

Cautiously restricting generalization to North American white children, it follows that the bizygomatic-incisor method advocated by Berger falls far short of qualifying as an "extremely sensitive" diagnostic tool for determining the "maxillary base." Its low level of clinical efficiency is evident, to wit: (1) of the twenty-two dental arches found by orthodontic examination to show lack of space, less than 40 per cent were so classed by the bizygomatic-incisor relation and (2) of the thirty-one dental arches selected as having lack of space by the bizygomatic-incisor relation, less than 30 per cent gave evidence of lack of space on orthodontic examination.

BIZYGOMATIC WIDTH AND ARCH WIDTH AT THE MAXILLARY FIRST MOLARS

Having presented a research evaluation of one of the two proposals under consideration, we now turn to an appraisal of the proposal for determining the biologically correct width of the maxillary dental arch in the region of the permanent first molars. Berger[1-3] posits that among children with orthodontically normal maxillary arches, there is a high positive association between bizygomatic face width and width of the arch at the permanent first molars. He interprets this concomitance as "constitutionally determined" and as carrying the implication that orthodontic treatment should re-establish the relation (when not correct) and never disturb it (when correct).[1]

In our sample of 100 11-year-old white children, there were seventy-eight (thirty-nine of each sex) with orthodontically normal maxillary arches.* The casts of these arches were measured to obtain (1) the minimum straight-line distance between the right and left lingual surfaces of the permanent first molars and (2) the maximum transverse diameter between the buccal surfaces of the right and left permanent first molars. Collection procedures paralleled those previously described in obtaining the records of incisor width.[8]

Employing the Pearson r method of correlation, coefficients were computed, specific by sex, for bizygomatic diameter with each bimolar width. The r' obtained were 0.32 on boys and 0.39 on girls for bizygomatic diameter with maximum interbuccal width at the permanent maxillary first molars, 0.35 on boys and 0.29 on girls for bizygomatic diameter with minimum interlingual width at the permanent maxillary first molars. These results do not support Berger's assertion that there is a "high correlation" between bizygomatic face width and bimolar width of the maxillary dental arch.[3] Rather, they reinforce the generalization that bizygomatic diameter and width of the maxillary dental arch in the region of the permanent first molars "are not highly related."[9]

It is pertinent that the low correlations obtained in this study on children 11 years of age are similar to those reported by Channing and Wissler[4] on 111 adult males ($r = 0.38$ for bizygomatic diameter with maxillary arch width at the permanent first molars), by Meredith and Hopp[10] on forty boys 6 years of age ($r = 0.37$ for bizygomatic diameter with maxillary arch width at the deciduous second molars), by Zeiger[12] on thirty-four girls 5 years of age

*Arches were accepted as orthodontically normal when no treatment involving the bimolar width (for example, expansion, contraction, or extraction) was indicated.

($r = 0.33$ for bizygomatic diameter with maxillary arch width at the deciduous second molars), by Smyth and Young[11] on ninety-eight children 2 to 5 years of age ($r = 0.33$ for bizygomatic diameter with maxillary arch width at the deciduous first molars), by McIver[6] on fifty girls 8 years of age ($r = 0.21$ for bizygomatic diameter with maxillary arch width at the deciduous canines), and by Holcomb and Meredith[5] on seventy-three boys 5 years of age ($r = 0.24$ for bizygomatic diameter with maxillary arch width at the deciduous canines).

The relationship of bizygomatic face width to arch width between the maxillary permanent first molars is appraised as being too low to warrant recommendation for use in orthodontic diagnosis. The accumulated findings to date lead to the conclusion that when bizygomatic diameter is employed to estimate maxillary arch width at the permanent first molars (or at the deciduous molars or canines), the long-run efficiency of estimation is very poor. Statistically, this is registered by the fact that the index of efficiency lies below 10 per cent for r's smaller than 0.43.

SUMMARY

This article reports a study of two metric relationships proposed for use in orthodontic diagnosis. The common dimension in both relationships is bizygomatic face width. One proposal recommends its use to determine the biologically correct width of the maxillary dental arch in the region of the permanent first molars. The other recommends its use to determine whether or not the maxillary base is adequate to carry the patient's mixed and permanent dentitions.

Both proposals are investigated on a sample of North American children of northwest European ancestry. Neither is found to function effectively for the purpose designated. Consequently, with particular reference to orthodontic treatment of children of northwest European ancestry, both proposals are appraised as not supplying sufficiently dependable and significant information to warrant their use in diagnosis.

REFERENCES

1. Berger, H.: Constitutional Aspects of Orthodontic Problems, AM. J. ORTHODONTICS AND ORAL SURG. **26**: 566-583, 1940.
2. Berger, H.: Twenty-five Years' Experience With the Zygomatic Method, AM. J. ORTHODONTICS **38**: 369-381, 1952.
3. Berger, H.: Constitutional Approach to Differential Diagnosis, Transactions of European Orthodontic Society for 1955 (reprint, 16 pages).
4. Channing, Walter, and Wissler, Clark: The Hard Palate in Normal and Feeble-Minded Individuals, Anthrop. Papers Am. Mus. Nat. Hist. **1**: 283-349, 1908.
5. Holcomb, Albert E., and Meredith, Howard V.: Width of the Dental Arches at the Deciduous Canines in White Children 4 to 8 Years of Age, Growth **20**: 159-177, 1956.
6. McIver, James E.: Relations Between Widths of the Face, Teeth and Dental Arches, Unpublished M.S. Thesis, University of Iowa, 1956.
7. Meredith, Howard V.: Growth in Bizygomatic Face Breadth During Childhood, Growth **18**: 111-134, 1954.
8. Meredith, Howard V., and Cox, George C.: Widths of the Dental Arches at the Permanent First Molars in Children 9 Years of Age, AM. J. ORTHODONTICS **40**: 134-144, 1954.

9. Meredith, Howard V., and Higley, L. Bodine: Relationships Between Dental Arch Widths and Widths of the Face and Head, AM. J. ORTHODONTICS **37**: 193-204, 1951.
10. Meredith, Howard V., and Hopp, Wayne M.: A Longitudinal Study of Dental Arch Width at the Deciduous Second Molars on Children 4 to 8 Years of Age, J. D. Res. **35**: 879-889, 1956.
11. Smyth, Corisande, and Young, Matthew: Facial Growth in Children, With Special Reference to Dentition, Medical Research Council, Special Report Series, No. 171, London, 1932, His Majesty's Stationery Office.
12. Zeiger, Wayne L.: Relationship Between Widths of the Dental Arch and Widths of the Head and Face, Unpublished M.S. Thesis, University of Iowa, 1948.

THE BURLINGTON ORTHODONTIC RESEARCH CENTRE

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PREVENTIVE measures are the most important factors in safeguarding the health of a person; nevertheless, in the practice of orthodontics the amount of valid information available on preventive methods is extremely small. An awareness of this need and the recognition of its importance prompted the Faculty of Dentistry at the University of Toronto to establish, in 1952, an Orthodontic Research Centre in Burlington, Ontario. Burlington was chosen for this study because it was close to the University of Toronto and was a typical small residential town (with a population of approximately 9,000).

The Burlington Lions Club supplied the initial office space, while the project is financed by a grant-in-aid through the Federal Department of Health and Welfare, with some additional support from the Division of Dental Research, University of Toronto. The Centre has for its staff a geneticist, four orthodontists, two pedodontists, a technician on a part-time basis, and a full-time secretary.

The objectives of the project are:

1. To evaluate the application of interceptive orthodontic procedures to children on a serial basis beginning at 3 years of age. The actual treatment of dental caries is carried out by the local dentists, while the Research Centre treatment involves the use of space maintainers, space regainers, acrylic bite planes, cribs, lingual and labial arch wires, and monoblock type of appliance therapy.

2. To analyze and define the characteristics of normal and abnormal occlusion.

3. To assess the role of inheritance in determining a number of clinically significant characteristics of cranial and facial growth.

4. To compile a library of data for future studies.

MATERIAL FOR THE STUDY AND EXPERIMENTAL DESIGN

The 1,265 children whose parents consented to their participation in the study are aged 3, 6, 8, 10, and 12 years, and represent 85 to 90 per cent of all Burlington children of these ages (Tables I and II). A complete set of records has been taken for the children in the control group aged 3, 6, 8, 10, and 12 years. These records serve as a control indicating the condition and the treatment needs of the children. The parents are advised concerning the child's

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TABLE I. AGE AND SEX DISTRIBUTION OF CONTROL GROUP FOR WHOM A COMPLETE SET OF RECORDS IS ON FILE

AGE AT NEAREST BIRTHDAY (YEARS)	MALE	FEMALE	TOTAL
3	134	104	238
6	167	136	303
8	96	126	222
10	112	107	219
12	116	102	218
Total	625	575	1,200

need for operative or orthodontic treatment. For the serial study, annual records are being taken for the 320 3- and 4-year-old children as near as possible to their birthdays. The fourth set of these serial records is now being obtained and it is planned to continue taking annual records until the children reach a minimum of 12 years of age. Each child's facial development and occlusal status are assessed annually, and treatment is prescribed when necessary.

TABLE II. AGE AND SEX DISTRIBUTION OF SERIAL GROUP FOR WHOM ANNUAL RECORDS HAVE BEEN TAKEN TO DATE

SEX	3 YEARS	4 YEARS*	5 YEARS	6 YEARS	7 YEARS	8 YEARS
Male	134	163	133	70	1	–
Female	104	140	111	67	1	–
Total	238	303	244	137	2	–

*Four-year-olds were added to the initial 238 children begun as 3-year-olds in order to insure a larger sample for the serial study.

DESCRIPTION OF RECORDS

The records, which are taken as close as possible to the month of the child's birthday, consist of the following:

1. Case history, which is a three-page medical and dental history. This information is collected by asking the same questions of each mother.
2. A clinical examination to assess growth and occlusion.
3. Six cephalometric radiograms employing the high-kilovoltage technique. These include: three lateral radiograms—rest position, occlusal contact position, and open position; two oblique radiograms—left and right sides; and one anteroposterior position.
4. One wrist radiogram, for determining the carpal index.
5. Impressions and wax bite for dental casts.
6. Where necessary, periapical films are taken.
7. Height and weight records.
8. Electromyographic records are available for some persons.

Although the evaluation of interceptive orthodontic treatment between the ages of 3 and 12 years is the initial aim of the study, the opportunities for other types of research provided by this project are considerable. The study

offers, moreover, unique opportunities for the investigation of the role of inheritance in growth and development of the face. Since the sample includes many related children, and since similar records have been taken for each child, when the 3-year-old children reach 6 years of age, it will be possible to establish hereditability and probability values for certain characteristics.

Since the initiation of the project four and one-half years ago, 2,211 complete sets of records have been taken and 120 children are undergoing treatment. Precise notes are recorded as to method of treatment used and the exact time spent on each case. In addition, a number of research papers have been completed from the data so far accumulated, while a number of other problems are in the process of being investigated.

Now that the data are being analyzed, it is anticipated that the results obtained will in some measure clarify and add to our knowledge of facial growth and development. Significant studies regarding the role of heredity in problems of facial growth at various ages will have been completed in a few years' time. Moreover, data from this study may form a valuable guide in preventive and interceptive orthodontic treatment, when a comparison of the identical records is made between the treated serial group, their parents, and the untreated serial and cross-section groups of children.

THOUGHTS ABOUT MEMBERSHIP IN THE AMERICAN ASSOCIATION OF ORTHODONTISTS

WM. R. ALSTADT, D.D.S., LITTLE ROCK, ARK.

IT WOULD seem reasonable to suppose that if the members of the American Association of Orthodontists realized the many factors involved with regard to admission to membership in the Association they would feel kindly toward graduate, postgraduate, and associateship training in orthodontics.

As a practicing orthodontist who has enjoyed formal orthodontic training, as one who has worked with associates who have not experienced formal specialist training, and as one who has acquainted himself with the aims of the American Dental Association, I believe that the best interests of the dental profession, the orthodontic specialty, and the public can be well served by trying to evaluate the evidence now available concerning this important matter of membership requirements of the A. A. O.

Let me state at the very outset that I am definitely in favor of graduate and postgraduate training and also of associateship training. There are many reasons why both *controlled* methods for admission to membership in the A. A. O. should not be condemned.

No one in the A. A. O. wishes to do anything that will prejudice the public against orthodontics or any other phase of dentistry. However, sometimes some of us forget that we are (1) American citizens, (2) dentists, and (3) specialists, and that we have serious public responsibilities and obligations in that order. The point is that each member, whether he be a general practitioner or a specialist, must realize that he is a part of the total dental health picture, and we must cooperate for the best interests of the public and of the dental profession.

The American Dental Association, being the parent body of all of the seven specialties as well as the general practitioners of dentistry, has an important agency that deals with the supervision of all dental education. This is the Council on Dental Education. Their report of 1956-57 reveals:

> For the past several years there has been an increasing interest in graduate and post-graduate study in dentistry, both on the part of dentists interested in preparing for specialty board examinations and from practitioners interested in extending or bringing up to date the training which they received while in dental school. *At the present time, the Council does not have a procedure for approving or recognizing graduate or post-graduate training offered by the dental schools or by other institutions with established programs for advanced study in dentistry.*

So long as the public and the dental profession are being served capably, the Council on Dental Education of the American Dental Association does not

wish to interfere with the programs of any specialty; however, this Council is charged with the responsibility of working for the best interests of the public and of the profession. I assure you that this Council is made up of nine outstanding leaders of the profession. They have an excellent staff which assembles detailed reports on all the activities regarding dental education.

There are only twenty-one graduate programs in orthodontics at present; these vary in length from twelve to forty-eight months. There are only thirteen postgraduate programs in orthodontics at present, varying from nine to twenty-four months on a full-time basis and from nine to forty-eight months on a part-time basis.

This information is given so that you will readily see that not all of the forty-five dental schools are staffed or equipped to give graduate or postgraduate training in orthodontics and also to point out that there is no standardization of courses with respect to scope or length of time required. I am not in the least critical of the Council on Dental Education, but this information serves to point out the vastness of this program of graduate and postgraduate training. While most orthodontists appreciate the desirability of formal training, we should attempt to understand the problems of the dental schools and at the same time realize the public's need for adequate orthodontic services.

American Dental Association records show that, due to the demand of the general practitioners as well as specialists, nearly all of the dental schools provide some short continuous or refresher type courses which vary in the length from one or two hours to two or three weeks.

All graduated dentists are legally permitted to practice all phases of dentistry, and technically they are permitted to limit their practice. In only nine states must a dentist take a special examination in order to call himself a specialist. The dental profession is relatively new and the profession itself has recognized officially several specialties for only a relatively short time, even though the societies and the academies have existed for a longer time. Hence, it follows that there are still relatively few men who are diplomates of the specialty boards (about 1,300 in all seven specialties) and this number will not grow rapidly.

During this growth period, however, the specialists will come from two primary sources. First, most of them will come from the ranks of the young graduates of dentistry who are interested in pursuing graduate and postgraduate programs combined with other methods of advanced training as found in internships, residencies, and preceptorships or associateships. The second source, and an important one also, includes the men who are now in general practice but who, through their special interests, are giving increased attention to one area of practice in preference to the other areas. This is a laudable ambition and, if specialists are needed by the public as we believe that they are, these men are to be commended. Therefore, it would seem that we should not only encourage the promotion of package educational programs

that provide for the training of recent graduates to meet the board requirements, but we should also provide for educational experiences that permit the dentist in practice to improve his knowledge and skill in these special areas of dentistry. It is recognized that these special training programs may not lead to advanced degrees, and they may not even lead to board diplomacy, but they will and should help the practitioner. Perhaps the societies and the academies should recognize this need if they agree that specialists are important and that more well-trained specialists are needed.

However, it would seem to be to the advantage of the public and the profession if more courses were developed to accommodate those men already in practice who are attempting to serve this need and yet do not have the time to devote to the package two-year programs; some of them may not have graduated recently enough to be eligible for admission to all of the advanced programs. It may be that the preceptorship or associateship program has more utility, long range, in programs with this objective than it does, long range, for the more formal programs. It may be, too, that one should consider the true function of the academies and the societies as apart from the specialty boards. If the societies and the academies are to have as their function (and I believe that they express this) the encouragement of men to seek further training in these fields, then this might be an objective that should be reviewed with considerable care.

Another factor that specialists must seriously consider is that of relations with the public and with the general practitioners of dentistry. Our deliberations should be such that the public and the general practitioners will not have the opinion that we are attempting to resist the efforts of more dentists to study orthodontics. Because of this unrealistic attitude toward our very reason for existing as specialties—to serve as a part of the total health picture—some of the dental specialties are already being accused of this procedure.

General practitioners, as a rule, have less public recognition and a lower income than is accorded specialists. Dental students today are talking well in advance of graduation about becoming oral surgeons, orthodontists, or other specialists.

Surely our actions should be to convince the general practitioners of dentistry, who are the very backbone of our profession, that we are sincerely interested in their problems as well as ours. While we have a total of approximately 3,200 specialists, approximately 1,600 of whom are orthodontists, we still do not have as many specialists in either civilian or military life as we actually need. I will readily agree that distribution is one of our most difficult problems; an equitable distribution of specialists can be accomplished only through socialism, and none of us desire this situation.

Martin Fisher said, "The specialist is too commonly hypertrophied in one direction, and atrophied in all the rest." This is an attitude which only specialists can, by their own actions, affirm or deny.

Adopting any reasonable or unreasonable requirements for membership in the American Association of Orthodontists will not prohibit dentists from specializing, and almost any practitioner wishes to join his specialty group, attend meetings, and thus benefit the public which he serves. Making unreasonable restrictions will not deter him from specializing, but it could possibly lead to "study groups" or "splinter groups" and create disharmony that benefits no one. This situation inevitably leads to a lowering of ethical standards.

Surely it is better to get the good men into our Association, where they can be exposed to better orthodontics, than to refuse them admittance merely because of their lack of *formal* orthodontic training. Personally, I do not agree with those who feel that only a person who has had formal training can become a member of the A. A. O.; nor do I agree with those, on the other hand, who belittle all formal training.

Charles F. Kettering made a statement that is very apropos: "The world hates a change, yet it is the only thing that has brought progress." The specialty of orthodontics has made great progress; I hope that we will continue to progress as rapidly as possible, but within the framework of reality.

In view of the many factors involved at this time, as a member of this organization and also as president-elect of the American Dental Association, I want to reiterate that I personally approve and want to encourage more formal training, but I also realize the value and the necessity of continued controlled associateships as requirements for admission to the American Association of Orthodontists.

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Editorial

Radiation Study

IF THE material published in both the lay press and the scientific journals devoted to the health services is any criterion, the statement by the United Nations Scientific Committee on the effects of atomic radiation should be given careful thought and consideration by the health services. The responsibility and cooperation of both the medical and the dental professions are being sought in an effort to gain more knowledge of the subject. Since it has become evident that radiation resulting from diagnostic radiotherapy constitutes a substantial proportion of the total radiation received by the human race, the committee considers it desirable to draw attention to information that has been obtained on this subject.

The committee plainly is trying to secure information that will tend to help reduce radiation of the population by improvements in technique, fuller training of personnel, local shielding of the gonads, and avoiding repetition of identical examinations.

The committee desires the full cooperation of the professions in arriving at a unit of total radiation received by the germinal tissues of the population, particularly before and during the childbearing age. It considers it essential that standardized methods of measurement, of types at present available, should be widely used to obtain this information by both the medical and the dental professions.

No doubt it will not be long until responsible dental and medical organizations will be asked for full cooperation in allowing radiation to be evaluated fully by responsible agencies.

It is understood that some cautious operators make a practice of constant check against x-ray leakage in their offices. Some attach a film with coin attached to their uniforms while in the x-ray room.

If all dentists would practice the above precaution, the results should interest the United Nations General Assembly in studying the effects of radiation and it might be at least a start toward re-examination so that more will be known about the question that has received such wide publicity in the lay magazines and newspapers.

Obviously, the overdose idea of dental x-rays is being overdone, even though the facts will not be fully known until there is re-examination by the professions, technical personal, and nuclear scientists.

H. C. P.

Reports

A FACTUAL REPORT ON THE ACTIVITIES OF A. A. O. COMMITTEES ON ADMISSIONS

AT THE request of President Broussard, I have prepared this brief review of the recommendations of the two special committees on requirements for admission to the American Association of Orthodontists and the subsequent action of the Association.

For some years the Great Lakes Society of Orthodontists required academic training as the prerequisite for membership. In 1953, at the St. Louis meeting, the A. A. O. voted to require all component societies to change their constitutions to conform to those of the A. A. O. Since there was considerable discussion on this question, President Ford appointed a special committee to study the requirements for admission to the A. A. O. This committee consisted of George Hahn and Alton Moore, Pacific Coast Society of Orthodontists; Brooks Bell, Southwestern Society of Orthodontists; Ashley Howes, Northeastern Society of Orthodontists; Faustin Weber, Southern Society of Orthodontists; Ernest Bach and Scott Holmes, Great Lakes Society of Orthodontists; and John R. Thompson (Chairman), Central Section of the American Association of Orthodontists.

This committee deliberated the problem by correspondence and telephone for several months, and three reports were presented to the Board of Directors in Chicago in 1954. Drs. Hahn, Moore, Howes, Weber, Holmes, and Thompson presented a majority report; Dr. Bell presented a minority report; and Dr. Bach gave a special report. The minority report deviated from the majority report in that Dr. Bell desired some plan to include preceptor training. The majority report was accepted and the following amendment to the constitution was submitted to the membership by mail sixty days prior to the 1955 San Francisco meeting:

> A person who has been in the exclusive practice of orthodontics for at least three years and has successfully completed an orthodontic course of a minimum of 1,500 hours in an approved dental school and is a member in good standing in his local, state, and national dental organizations may be elected to active membership through the constituent society. He must be recommended by two active members. (This amendment to become effective two years from the date of adoption.)

This amendment was passed at the San Francisco meeting under President West. It will become effective in May, 1957.

It was also voted at that meeting to appoint a new special committee to study the question further. President Adams, who took office in San Francisco, appointed the following members to this committee: George Hahn, Andrew Jackson, Ernest Bach, Brooks Bell (Co-chairman), and John R. Thompson (Co-chairman).

This committee likewise deliberated the question, and a majority and a minority report were presented to the Board of Directors at the Boston meeting in 1956. Drs. Jackson, Bach, Thompson, and Bell supported the majority report and Dr. Hahn prepared the minority report.

The modified majority report, which has now been submitted by mail to the membership and which is to be voted on at the 1957 New Orleans meeting, reads as follows:

SECTION 2. ELIGIBILITY OF ACTIVE MEMBERS.

(A) A person who is in the exclusive practice of orthodontics* and who is a member in good standing in his local, state, and national dental organizations may be elected to active membership through his constituent society, provided the applicant has been:

1. Five years in the exclusive practice of orthodontics, including a successfully completed orthodontic course of a minimum of 1,500 hours in an approved dental school. The applicant must be recommended by two active members of the constituent society within the jurisdiction of which he intends to practice.

or

2. Five years in the exclusive practice of orthodontics, at least three consecutive years of which shall have been in the office of, and in full-time association with, a practicing member of the American Association of Orthodontists. This practicing member shall have been an active member of the American Association of Orthodontists for not less than eight years. The applicant must be recommended by two active members of the constituent society within the jurisdiction of which he intends to practice.

(a) Notice of the inception of this associateship shall be forwarded within thirty days to the secretary of the constituent society of which the senior associate is a member. The senior associate, who shall act as a preceptor to the junior associate, shall inform the secretary of his constituent society of the completion of the three years of associateship.

(b) Should this associateship be unavoidably terminated, the junior associate may apply for special consideration directly to the Admissions Committee of the constituent society within whose jurisdiction he practices.

3. The Admissions Committee of the American Association of Orthodontists shall consist of the director from each constituent society. This committee will establish uniform rules under which the Admissions Committee of the constituent societies shall operate.

The chairman of this committee shall be appointed by the president.

The initial majority report appears on page 780 in the October, 1956, issue of the AMERICAN JOURNAL OF ORTHODONTICS. It is followed by Dr. Hahn's minority report, which ended with the following statement: "Unless we are determined to lower the requirements for membership in the American Association of Orthodontists, I see no valid reason for either repudiating or changing without giving a fair trial the amendment to the by-laws adopted at San Francisco in 1955."

*Exclusive practice as used in these By-Laws shall mean that the member shall not engage in any type of practice other than that traditionally associated with the practice of orthodontics.

The majority report differs from the previously adopted change in the constitution in that preceptor training is accepted. It is important to note that this training consists of a minimum of three years' full-time association in the office of an individual who has been an active member of the American Association of Orthodontists for not less than eight years. The senior associate would also be required to inform the secretary of his constituent society of the inception of the association within thirty days and also of its completion at the end of three years. This places the senior associate in the position of assuming responsibility for the training of the junior associate. It should also be noted that an Admissions Committee would be created and that it would formulate uniform rules for the operation of the Admissions Committees of the constituent societies.

In the event that the proposed amendment is passed, it will become effective at that time, replacing the previous amendment which was adopted in San Francisco in 1955 and which would become effective in May, 1957.

JOHN R. THOMPSON,
Co-chairman of the Special Committee
on Requirements for Admission to the
A. A. O.

In Memoriam

HOMER BLACKBURN ROBISON
1881-1957

HOMER B. Robison of Hutchinson, Kansas, died on Feb. 11, 1957, after an illness of several months.

The professional practice of Dr. Robison began in 1907, when he received his degree at the Kansas City–Western Dental College, Kansas City, Missouri. Immediately afterward, Dr. Robison began to practice dentistry in Ellinwood, Kansas. He later attended the International School of Orthodontics in Kansas City, and during his years of general practice took numerous graduate courses leading to a mastery of the field of orthodontics which won him wide recognition, both as a theorist and in practice. He moved to Great Bend in 1921, and there limited his practice to orthodontics. In 1929 he moved to Hutchinson and continued in that field of specialization.

Dr. Robison served as instructor at both the International School of Orthodontics in Kansas City and the Dewey School of Orthodontics in New York City. He also served as lecturer at Northwestern University Dental School in Evanston, Illinois, and at the Hutchinson School of Nursing in his home city. In addition, he made many appearances as a lecturer before meetings of medical and dental societies, dental hygienists' and assistants' groups, and parent-teachers, nursing, and other organizations in various parts of the country. He was the author of the following works: "The Biologic Concept of Orthodontics" (*Journal of the American Dental Association,* 1933); "Muscle Functioning and Retention" (published in the same periodical, 1931), and "Acromegaly, Mongolism and Cretinism, and Effect Upon Occlusion," which appeared in the first edition of the *Journal of the Japan Orthodontic Society.*

Dr. Robison was active in the Kansas State Dental Association. He was a member of the special committee which helped create and develop all the district dental societies in the state when the Kansas State Dental Association became a constituent part of the American Dental Association in 1933. For a number of years it has been the practice of his state professional group to honor one outstanding member of the profession each year. At its eighty-third session, held in Wichita, May 16 to 19, 1954, Dr. Robison was selected guest of honor. He became president of the Kansas Dental Association in 1929, and during his tenure was instrumental in organizing the Kansas State Dental Assistants' Association, whose program has materially improved the quality of personnel. Dr. Robison also stimulated the organizing of the Kansas State Dental Hygienists' Association. He was vice-president of the American Dental

Association in 1936, vice-president of the American Association of Orthodontists in 1951, and president of the Southwestern Society of Orthodontists in 1930. He served on the executive council of the Kansas State Dental Association, and had been its delegate to the American Dental Association for many years. He was a fellow of the International College of Dentists, a fellow of the International Academy of Dentistry, and a member of the American Association of Orthodontists, Southwestern Society of Orthodontists, Central District Dental Society of Kansas, Hutchinson Dental Society, American School of Dentistry for Children, American School Health Association, and the American Board of Orthodontists. He served in many committee connections in these various professional organizations.

Dr. Robison was born April 16, 1881, at Mt. Pleasant, Pennsylvania. He was a member of the first Presbyterian Church, the Rotary Club, Elks Lodge, and the Ellinwood Masonic Lodge.

Surviving are his widow, Christina; two daughters, Mrs. John Dudley of Seattle, Washington, and Mrs. Norman Biberdorf of Fargo, North Dakota; a son, Duane of Fort Lewis, Washington; two brothers, Judge Corbin E. Robison of Fort Morgan, Colorado, and Dr. Norval Robison of Bison, Kansas; and four grandchildren.

Department of Orthodontic Abstracts and Reviews

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Calcification of the Mandibular Third Molar and Its Relation to Skeletal and Chronological Age in Children. By Arthur Demisch and Peter Wartmann. Child Development **27**: 459-473, December, 1956.

It is reasonable to expect that an intimate relationship exists in the physical maturation of various tissue systems and that this relationship is reflected by the different maturity indicators, although the correlation between dental development and growth of the body as a whole is claimed to be low. It has been demonstrated that children with late emergence of permanent teeth were usually delayed in both height and weight gain when appraised by referring to the Fels norms, and that children with early eruption of teeth were advanced in their physical growth. The association between these three variables was demonstrated most clearly for children with late eruption of teeth. Gleiser and Hunt and others reported that arrests in the ossification of hand and wrist bones often coincide with arrests in tooth formation.

This study deals with the calcification of the mandibular third molar since it is desirable, especially for the orthodontist, to have this information for evaluating dental development between the ages of 9 and 15 years. The relationships between third molar development and chronological and skeletal age were studied also.

A total of 151 American white children of Greater Boston, who were patients at the Forsyth Dental Infirmary for Children and without obvious signs of nondental disease or of developmental disturbances, were selected for examination according to the year of birth. When the eighty-one boys and seventy girls were grouped according to age, the resulting frequency distributions differed considerably from those based on the year of birth due to the time lapse between the examination of the first and last subjects. Roentgenograms of the right hand and wrist and of the jaw were made.

The hand roentgenograms were analyzed according to the standards of Greulich and Pyle. Differences in evaluating skeletal age were determined by independent examinations of the hand roentgenograms of thirty children (fifteen boys and fifteen girls). The results show a high degree of similarity between the readings made by the two observers.

For the evaluation of the calcification of the mandibular third molars, use was made of the standards developed by Gleiser and Hunt for the first molar. An attempt was made in the initial stage of this study to find suitable developmental stages for gauging the calcification of the third molar. This resulted in almost the same scale as that of Gleiser and Hunt, except that Stage 6 (two-thirds of crown completed) could not be differentiated accurately from its neighboring stages and it was, therefore, omitted. Stage 6 in the present

study, signifying completion of the crown, corresponds to Stage 7 of Gleiser and Hunt and Stage 7 (the beginning of root formation) to their Stage 8. The definitions of each calcification stage as used in this study are given in Table I.

TABLE I. DEFINITIONS OF EACH STAGE OF THIRD MOLAR CALCIFICATION USED IN THIS STUDY

0. No change in bone density, and no crypt visible.
1. Crypt clearly visible, but no calcification.
2. Calcification of the tips of one to four cusps.
3. Coalescence of two or more centers.
4. Outline of the cusps completed, calcification progressing toward the level of the grooves, but the center of the occlusal crown surface may not yet be calcified.
5. Half of the crown completed, calcification up to the largest mesiodistal diameter of the tooth crown, but the entire enamel formation not yet completed.
6. Crown completed, enamel formation completed to enamel-cementum junction.
7. Beginning of root formation.

Differences in assessing mandibular third molar development were determined by independent evaluation of fifty lateral jaw radiographs. Since Stage 5 offered the greatest difficulties for proper classification, a larger number of teeth in this stage than in the other stages of development was selected by the first examiner to test whether his co-observer agreed with the rating given. The disagreement in evaluations of third molar development was never more than one stage.

The errors made by the two observers in studying third molar development are often greater than those made by them in assessing skeletal age.

The findings can be grouped under four headings, namely: (1) the relationship between skeletal age and chronological age, (2) degrees of bilateralism in the development of left and right third molars in the mandible, (3) the median chronological and skeletal ages for each calcification stage of these third molars, and (4) the mutual relationships between third molar calcification and skeletal and chronological age.

The mean difference between skeletal age and chronological age is 0 months in the eighty-one boys and 6 months in the seventy girls studied. Thus, in the average girl the skeletal age is one-half year advanced compared to the chronological age. The range of approximately 48 months for both sexes corresponds closely to the findings of Greulich and Pyle. In a group of "normal," early-, and late-maturing children, therefore, one may expect differences as great as 24 months between the two measures of development.

Chronological symmetry in the development of the mandibular left and right third molars occurs in 71 per cent of the boys and girls. In the others, differences of one, but not more than two, developmental stages are observed in the calcification of antimeres. It is not possible to conclude from the data at hand whether a definite trend exists for more advanced development on one side of the mouth than on the other.

Unilateral agenesis must be considered also as an asymmetry of development. However, great care was necessary in diagnosing agenesis inasmuch as the beginning of calcification, as manifested in radiographs (Stage 1), was observed as late as 12 years 5 months in some children.

In the small sample of boys 13 years 1 month and older (twenty-one), the combined frequency of unilateral and bilateral mandibular third molar agenesis was 9.5 per cent and in the still smaller group of girls (seventeen) it was as high as 35.3 per cent.

In both sexes the median chronological and skeletal ages of third molar stages agree closely, the maximum difference being 7 months for Stage 3 in both boys and girls.

A high degree of association exists between third molar calcification and skeletal or chronological age as well as between skeletal and chronological age.

In view of the comparatively small but significant partial correlation coefficients between third molar calcification and skeletal age with chronological age held constant, it may be possible to estimate skeletal age indirectly when taking into account the development of other permanent teeth in addition to the third molar if adequate calcification data for these other teeth are available, since averaging the variations in the development of individual teeth is likely to give a more realistic evaluation of the dental age.

The data presented support the basic theoretical contention that a relationship exists in the physical maturation of various tissue systems, and the chronology of dental development may prove to be useful as an indicator of physiologic age.

The results confirm the earlier studies concerning the wide range of skeletal ages compared with the chronological ages in "normal" children. The differences when two observers evaluate the same wrist radiographs independently are much smaller than the "normal" variation of skeletal age in "healthy" children at a given chronological age. The differences in independent ratings of third molar development are somewhat higher but are still adequate for the purpose of this study. Gleiser and Hunt's scale for rating the calcification of mandibular molar crowns appears satisfactory for clinical studies, except that their Stage 6, which could not be differentiated clearly from its neighboring stages, had to be omitted.

The calcification of the mandibular third molar is symmetrical in 71 per cent of the children studied. In the others, no tendency is seen for consistently advanced development of either the left or right teeth.

There is a high positive correlation between the degree of calcification of the mandibular third molar and the skeletal or chronological ages. The findings support the theoretical contention that a relationship exists between the maturation of various tissue systems.

Mandibular Growth and Third Molar Impaction. By Arne Björk, Elli Jensen, and Mogens Palling. *Acta odont. scandinav.* **14**: 231-272, 1956.

Failure of the wisdom tooth in the lower jaw to erupt completely is usually associated with lack of space in the alveolar arch between the second molar and the ascending ramus. This has been confirmed through biometric studies by Henry and Morant (1936) and is corroborated in the present study. The purpose of the study was to determine the essential factors in mandibular growth which concern the third molar space. Causes of incomplete eruption, apart from mandibular growth, were also examined. Retarded maturation of the dentition appears to be a factor to consider in the prognostication. The position of the third molar was evaluated from cephalometric profile x-ray films as well as from intraoral exposures.

Horizontal and angular impactions are defined by the inclined position of the third molar against the second molar, whereby eruption is impeded (mesio-oblique, horizontal, and inverted positions), or against the ascending ramus (disto-oblique position). These four subtypes have been selected in this investigation as representative of third molar impaction, the great majority of

cases displaying the mesio-oblique position. The transversal divergencies, deflections, are included, provided that they are associated with horizontal or angular impactions. In young adults the vertical impactions are difficult to distinguish from conditions of retarded eruption; therefore, these have not been included.

An accurate registration of the third molar space, the distance between the second molar and the anterior edge of the ramus on a level with the alveolar border measured on intraoral films, is not possible from lateral x-ray films. In the present study the M3 space was measured on cephalometric profile x-ray films as the distance between the distal surface of the second molar and the anterior edge of the ramus, on a level with the occlusal line of the mandibular dental arch. The occlusal line was defined as a line through the incisal edge of the lower central incisors and the center of the occlusal surface of the second molar. The profile roentgenograms used for measurements were open-mouth exposures.

Three factors of variation in development of size and shape of the mandible were related to the third molar space:

(a) Growth in length in proportion to amount of tooth substance. The distance from the mental protuberance to the condyle. The increase in total length of the mandible is a direct expression of the amount of condylar growth.

(b) Direction of condylar growth. Changes in shape during development may exert considerable influence on the third molar space. Until more is known about the modeling at the lower mandibular border, the choice of reference line must be more or less arbitrary. Two such possibilities have been investigated in this study: (1) the mandibular line defined as the tangent to the lower mandibular border and as the line drawn through the lowest point at the symphysis, touching the mandibular border at the angle region, and (2) a line through pogonion to the condylar point and to the mandibular base line.

(c) Directional trend of tooth eruption. There are considerable individual variations in direction of eruption. Consequently, the mandibular dentition, more or less in toto, will be carried forward or backward in relation to the basal structures of the mandible in the course of development. A backward-directed trend of eruption will diminish the length of the alveolar arch, thereby causing a decrease in space for the third molar. An accurate registration of the directional trend of eruption of the dentition is not possible by means of the conventional x-ray method. As a suitable measurement, the degree of alveolar prognathy was chosen, that is, the angle between the profile line of the bony chin and the mandibular line. As the increase in growth at the chin point is negligible a change in the alveolar profile angle during development will supply an expression of the shifting of the dentition in a retrognathous or prognathous direction in relation to the mandibular base.

The material for the Adolescent Growth Study Group consisted of cephalometric profile x-ray films of Swedish boys, examined at the age of 12 and 20 years, and includes the period of the pubertal growth spurt of the mandible. The material comprised 243 individuals, irrespective of dental condition.

In the upper jaw aplasia of the third molar occurs in 11 per cent, in the lower jaw in 16 per cent, calculated by numbers of teeth. Aplasia of one or two lower third molar teeth occurs in 20 per cent of the cases. At 20 years

less than half of the third molar teeth had erupted normally in each jaw. In this survey a tooth is recorded as erupted when in normal position and visible in the oral cavity. Information about the position of the extracted third molars was not available, and they were not recorded as impacted. Frequency calculations of impaction depend on the definition, on the age of the individual, and on the condition of the bite. The concept that insufficient space for the third molar in the lower jaw is an essential cause of its incomplete eruption has been corroborated in this investigation.

The M3 space was measured only in cases of complete dentition anterior to M3. The registration was made from the cephalometric x-ray films at the 20-year stage. In 114 of these cases, in which the measurement was technically possible to obtain, the arithmetic mean was calculated to 3.3 mm. with a standard deviation of 2.6 mm. The median value is 3 mm. and the range is 4 to 10 mm. The distribution of the whole group (114 cases) is practically normal.

It appears that the M3 space in 90 per cent of the cases with bilateral impaction is smaller than the median for the total group, in 80 per cent it is smaller than the median for the group with unerupted third molars in the normal position, and in no case does it reach the level of the median value for the group of cases with fully erupted third molars. From the foregoing, it is evident that the M3 space in cases of impaction of the mandibular third molars is markedly diminished.

The M3 space is larger in the group with fully erupted third molars than in the group with third molars unerupted but in normal position. The median values are 4.4 mm. and 2 mm., respectively.

The M3 space is smaller in the aplasia group than in the one with fully erupted third molars. These distributions are significantly different, as estimated by the X2 test. Besides, not a single case with extremely large M3 space can be found in the aplasia group. This favors the conception that the normal eruption of the third molar per se is important for the size of the M3 space. It is possible that the eruption of M3 may influence the resorptive rebuilding of the retromolar area. It is also possible that the eruption of M3 may influence the direction of the eruption of the anterior teeth and thereby increase the size of the M3 space. For the analysis of these questions, growth studies with metallic implants may be valuable.

In cases of impaction of the mandibular third molar, the space in the alveolar arch behind the second molar is considerably reduced. Therefore, lack of space for the third molar must be regarded as an essential cause of its impaction.

The development of the third molar space may be related to three essential factors in mandibular growth.

The M3 space is diminished when the mandible is short and when the bend of the mandibular base is pronounced. Its variation, however, is independent of the degree of alveolar prognathism as evaluated by direct measurement. On the other hand, it is known that these three factors in mandibular development are mutually correlated. This interrelation indicates that in case of large jaw length alveolar prognathism is often diminished and, consequently, the eruption of the teeth directed backward. In case of a slightly bent mandibular base alveolar prognathism is frequently diminished. This compensatory development of alveolar and dental arches eliminates the direct correlation between M3 space and alveolar prognathism.

The space for the mandibular third molar, the M3 space, is diminished (1) by low growth rate in length of the mandible, (2) by vertical direction of condylar growth, or (3) by backward-directed eruption of the dentition.

In the clinical evaluation of the importance of the backward-directed eruption for third molar impaction, the correlative interdependence among these factors must be considered. In individual cases they may either amplify or neutralize each other.

From a prognostic point of view, the question arises as to whether the risk of impaction may be estimated at an early developmental stage, that is, an age at which any reduction in the number of teeth is of current interest to the orthodontist. The level at 12 years supplies no hint regarding the estimation of size and direction of the adolescent growth.

Mandibular growth in length shows an appreciable association with third molar impaction, but other factors also play a role.

The importance of the direction of condylar growth to the formation of the M3 space and to the prospect of third molar eruption during adolescent growth is illustrated.

Evaluation of the directional trend of eruption of the dentition as a factor concerning third molar impaction should be made with special reference to its correlation with mandibular growth as a whole.

The risk of third molar impaction may be foreseen even at the preadolescent stage of development in case of an extremely short jaw length or an extremely large mandibular base angle. An extreme alveolar retrognathy at the same developmental stage would probably involve the risk of third molar impaction if the effect were not neutralized by a development in length and shape of the mandible favorable to the M3 space. As the preadolescent shape and size of the mandible provide no help in estimating the rate and direction in adolescent growth, the correct interpretation of the individual pattern of growth greatly facilitates the prognosis. The three factors in mandibular development should be regarded in orthodontic treatment planning, and prophylactic extraction of teeth should be considered.

The maturation of the third molar is another developmental factor considered in this study which bears some relation to incomplete eruption of the mandibular third molars.

An association was found between maturation and eruption of the mandibular third molars. In the subgroup with fully erupted mandibular third molars, extremely retarded maturation occurs in 3.5 per cent of the cases, compared with 50 per cent in the subgroup with mandibular third molars unerupted at the age of 20 years. An association is also found between M3 maturation and eruption of the other teeth. The number of unerupted permanent teeth is greater in 12-year-old boys with retarded mineralization of M3 than in those having a more advanced stage of M3 mineralization at the same age.

Retarded maturation of M3, as well as retarded dental maturation in general, must be considered of prognostic importance when the risk of third molar impaction is estimated. It has not been possible here to ascertain whether the cause of third molar impaction is referred to retarded maturation of M3 per se or to a general retardation in dental development. An association between maturation of M3 and development in length of the jaw may be assumed to exist as a fourth factor in third molar impaction.

An association has been demonstrated between impaction and retarded maturation of the third molar. Retarded maturation of M3, and possibly general retarded development of the dentition, is listed as a fourth factor in third molar impaction.

From a developmental viewpoint, growth in length and the change in shape of the mandible are associated. Likewise, the degree of alveolar prog-

nathy is associated with the development in length as well as in shape of the mandible. The development in shape of the mandible remains the skeletal factor of greatest importance to impaction, followed by jaw length and then by alveolar prognathy.

The four factors in combination account for M3 impaction in 82 per cent of the cases. Vertical direction of condylar growth has the greatest effect, followed by short jaw length and then by reduced alveolar prognathy.

The development of the mandibular third molar was examined in 338 male students at the Royal Dental College in Copenhagen. The report is confined to cases exhibiting a complete mandibular dentition anterior to M3. This group comprises 237 cases, or 67 per cent of all individuals examined. The age varies from 19 to 30 years. The development of the mandibular third molar in this group was checked by means of intraoral x-ray films. Seventy-two mandibular third molars (15 per cent) were missing due to aplasia, as calculated by numbers of teeth, in forty-eight individuals (20 per cent). These values are in complete accord with the corresponding data computed from the adolescent growth study group.

A greater number of mandibular third molars had been extracted in this group, as compared to the adolescent growth study group (7 per cent to 2.5 per cent). The number of unerupted mandibular third molars is smaller (17.5 per cent to 24 per cent).

The number of impacted third molars is larger (22 per cent) compared to the number among the complete dentition cases in the adolescent growth study group (16 per cent). Bilateral impaction occurs in 16 per cent of the cases and unilateral impaction in 13 per cent, making a total of 29 per cent. In the adolescent growth study group the frequency of unilateral or bilateral impaction was calculated at 19 per cent in cases of complete dentition anterior to M3. This dissimilarity in occurrence of impacted third molars might be attributed partly to the difference in age distribution and partly to the difficulty in defining the concept of impaction.

In the majority of cases of impaction, there is an extremely small M3 space. In 90 per cent of the cases the M3 space is smaller than the median value for the total 20-year group. For all practical purposes, the distributions of the M3 space in the impaction groups of both series are therefore identical.

SUMMARY

Computations of the frequency of third molar impaction depend on the manner by which impactions are defined, on the age of the examined persons, and on their dental condition as a whole. With the above reservations, impaction of the mandibular M3 may be expected in from every fourth to every fifth adult male in a Scandinavian population. In cases of impaction of the mandibular third molar, the alveolar arch space behind the second molar (M3 space) is considerably reduced in 90 per cent of the cases, as evaluated from cephalometric profile roentgenograms.

The space for the mandibular third molar is found to be diminished when (1) the growth rate in length of the mandible is slight, (2) the direction of condylar growth is vertical, or (3) the eruption of the dentition is directed backward. These three factors separately influence third molar impaction. In individual cases they may either amplify or neutralize each other. The development in size of the mandible is evaluated as the length from chin to condylar head. The direction of condylar growth, which determines the shape of the mandible, is indicated by the mandibular base angle. Finally, the direction of the eruption of the mandibular dentition is determined by the degree of alveolar prognathism of the lower jaw.

An estimation of the ranking order of the three skeletal developmental factors in third molar impaction shows that vertical direction of condylar growth has the greatest effect, followed by small mandibular length and then by backward-directed eruption of the dentition. Furthermore, a relationship was found between impaction and retarded maturation of the mandibular third molar. Retarded maturation of M3, or perhaps general retardation of dental development, constitutes the fourth factor of significance in the prognostication of third molar impaction. The combination of the three factors in mandibular development should be considered in orthodontic treatment planning, as should also the degree of dental maturation.

News and Notes

American Association of Orthodontists
1957 Annual Meeting

Final preparations are complete and soon the fifty-third annual meeting of the American Association of Orthodontists will be a reality.

The scientific program is designed to give you practical information that will enhance your orthodontic practice.

And, of course, in the "City That Care Forgot" the entertainment has not been neglected. This includes a get-acquainted cocktail party and buffet supper Sunday evening.

Spanish Patio, New Orleans

With the change in government from French to Spanish, the architecture in New Orleans was influenced by styles in vogue in Spain.

A charming characteristic was the patio garden, such as the one shown here, which was surrounded by the home in the front and smaller buildings and high brick walls in the back and on the sides.

Practically every home in the original section of the city, known as the French Quarter or Vieux Carre, has its patio. Typical features are fountains, tropical foliage, flagstone pavement, and the large jars in which olive oil was imported from Spain.

Visitors to the fifty-fourth annual meeting of the American Association of Orthodontists will enjoy a walk through this interesting section of the city which is only a few blocks from the hotels.

On Monday there will be a morning walking tour through the Vieux Carre for the ladies, and at noon the Anniversary Luncheon will be held. Tuesday afternoon, for the ladies, there is the Garden District Tour. The old homes which will be visited and their antique furnishings give a vivid picture of early New Orleans culture. Wednesday evening will be the President's Reception and Dinner Dance.

New Orleans has so many famous restaurants and attractions that Monday and Tuesday evenings have been left open for you to enjoy as you see fit.

If you have not done so, please send your entertainment reservations immediately to Dr. Robert B. Smyth, 1103 Maison Blanche Bldg., New Orleans, Louisiana.

Hotel reservations should be made through Dr. Bertney Frick, Jr., 1231 Maison Blanche Bldg., before April 27. After that date you will have to write directly to any one of the following hotels:

Roosevelt	Monteleone
De Soto	New Orleans
Jung	St. Charles

This is the meeting you cannot afford to miss, so we will be looking forward to seeing you soon.

THE LOCAL ARRANGEMENTS COMMITTEE

Rules Covering Visitors to the 1957 Meeting of the American Association of Orthodontists, May 13 Through May 16, Roosevelt Hotel, New Orleans, La.

To insure full participation of all members, it is necessary to limit attendance to fully privileged members of the American Association of Orthodontists and the following:

A. *No Attendance Fee*

1. Full-time teachers in university dental schools.
2. Full-time graduate or postgraduate students in university orthodontic departments.
3. Dentists from outside Canada or the United States of America who are members of recognized dental or orthodontic organizations.

B. *Attendance Fee $10.00*

1. Associate or junior members of constituent societies of the American Association of Orthodontists.
2. Recent graduates of university orthodontic departments who are in service.

C. *Attendance Fee $20.00*

1. Recent graduates of university orthodontic departments who are not members of constituent societies of the American Association of Orthodontists.
2. Other guests certified by the Credentials Committee.
   To qualify under this heading you must:
   (a) Be endorsed by two active members of the American Association of Orthodontists in your vicinity.
   (b) Be a member in good standing of the American Dental Association.
   (c) Not have been rejected for membership in any of the constituent societies.

Those desiring to attend the meeting who qualify under the categories listed above should contact the chairman of the Credentials Committee for approval of their credentials.

Credentials Committee,
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American Association of Orthodontists
Hotel Accommodations for 1957 Annual Meeting

Hotel accommodations for the 1957 meeting of the American Association of Orthodontists to be held May 12 through May 16, 1957, in New Orleans, Louisiana, will be made through the office of Dr. B. G. Frick, Jr., 1231 Maison Blanche Bldg., New Orleans 16, Louisiana.

All reservations of rooms will be made in the order in which the requests are received. It is recommended that you send in your applications as soon as possible, as requests must be received before April 27.

Our allotment of rooms is at the following hotels, all within a radius of three and one-half blocks from the headquarters hotel, the Roosevelt.

Approximate Range of Room Rates

Hotel	*Twin*	*Double*	*Single*	*Suites*
Roosevelt (headquarters hotel)	$14—15—18	$11—12	$8—9	$30 up
St. Charles	$13—14—15—16	$ 9—10—11	$6—7—8—9	
Jung	$11—12—14—15	$10—12—13—15	$7—8—9	
Monteleone	$12—13—14—15	$ 9—10—11	$6—7—8—9	
New Orleans	$11—12	$ 8— 9	$6—7	
De Soto	$10	$ 7— 8	$5.50—6	

Please indicate your first, second, and third choice of hotels and date of arrival.

Dr. B. G. Frick, Jr.
1231 Maison Blanche Bldg.
New Orleans 16, La.

Name: ----------

Address: ----------

Please make the following reservation for me to attend the A. A. O. convention in New Orleans, beginning May 12, at the following hotel:

Choice of Hotel	Type of Room and Approximate Rate
1 ----------	----------
2 ----------	
3 ----------	

Date of arrival ----------

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Frank Bernardi, D.D.S., M.S., announces the opening of his office at 401 East Capitol Ave., Springfield, Illinois, practice limited to orthodontics.

Dr. Henry A. Eitelberg is now located in the Williamsburgh Bank Bldg., 1 Hanson Pl., Brooklyn, New York, practice limited to orthodontics.

Dr. J. Jerome Hebert announces that he will continue the orthodontic practice of the late Dr. Arthur M. Schultzman, 604 Reymond Bldg., Baton Rouge, Louisiana.

Gordon K. Magnusson, D.D.S., M.S.D., announces the opening of his office at 628½ Sixth St., Rapid City, South Dakota, practice limited to orthodontics.

Dr. M. Albert Munblatt wishes to affirm his continuance of practice in the specialty of orthodontics at 66 West Park Ave., Long Beach, New York.

John Lee Smith, D.D.S., announces his entrance into the practice of orthodontics, Casa Linda Bldg., Dallas, Texas.

Donald Spencer Sterrett, D.D.S., announces the association of John D. Friedlander, B.D.S. (N.Z.), D.D.S., M.S.D., in the practice of orthodontics at 549 West Eighth St., Erie, Pennsylvania.

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1957—Roosevelt Hotel, New Orleans, Louisiana, May 12 to 16.
1958—Commodore Hotel, New York, New York, April 27 to May 1.
1959—Statler Hotel, Detroit, Michigan, May 4 to 7.

*Deceased.

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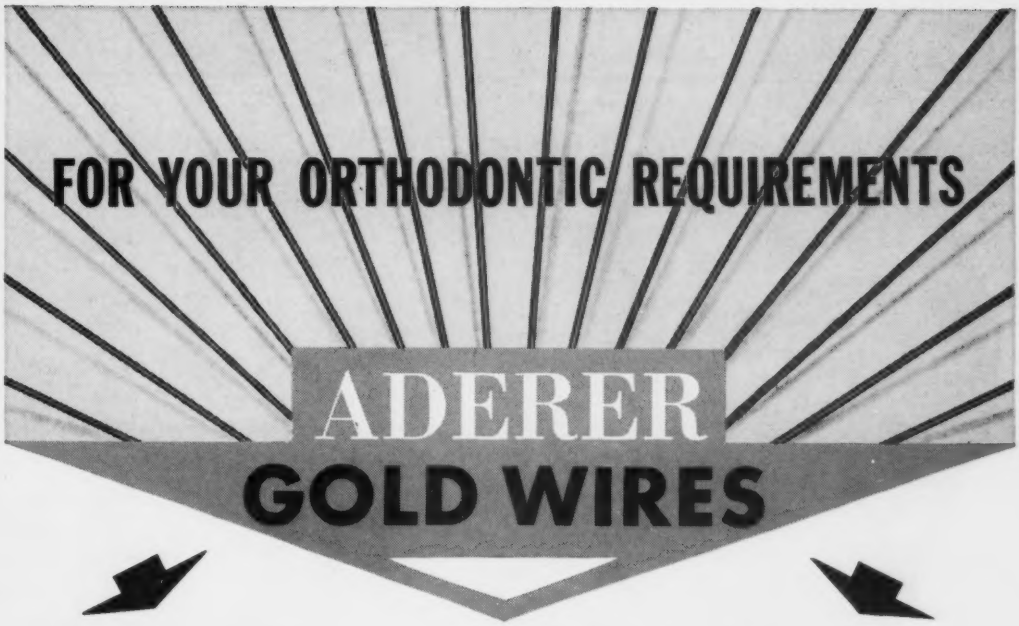

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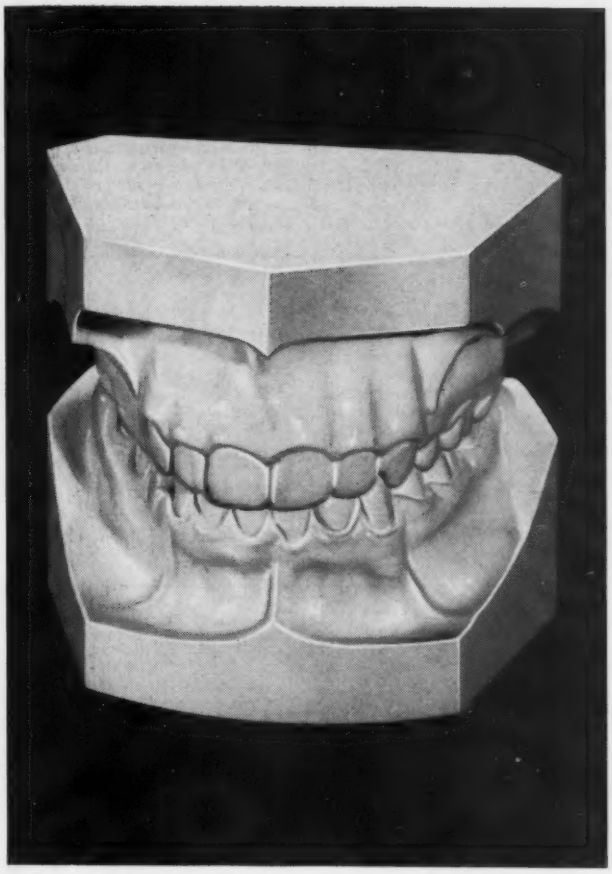

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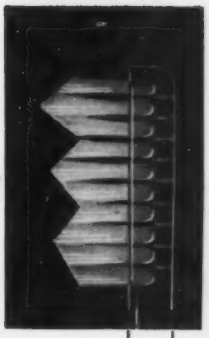

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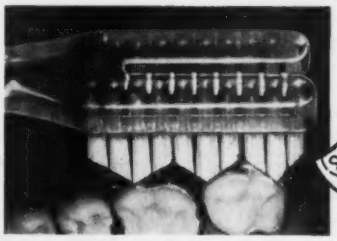

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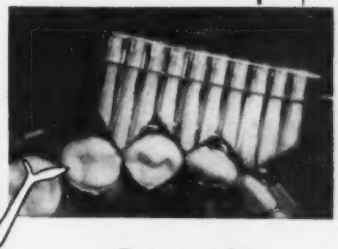

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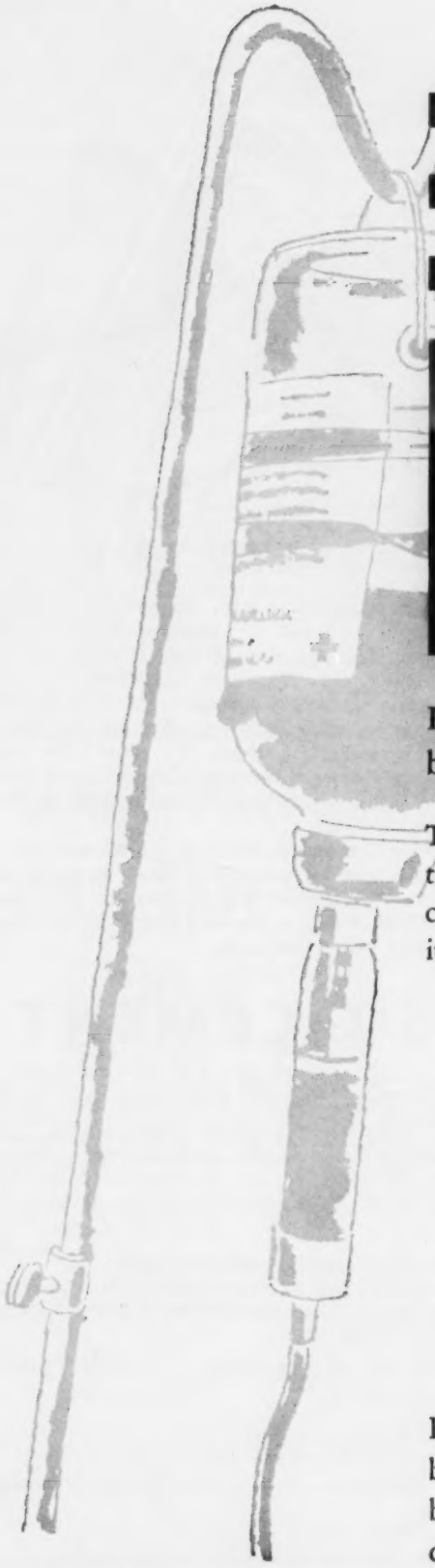

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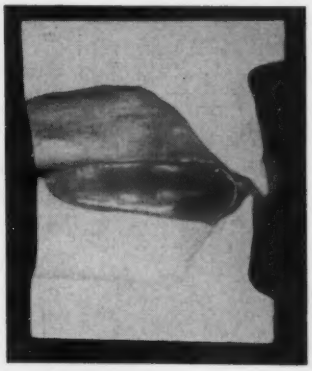

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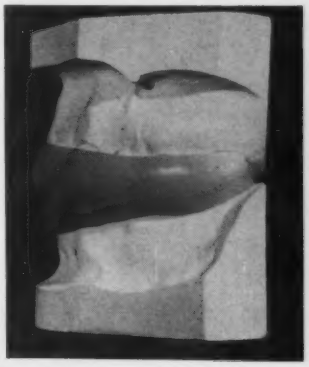

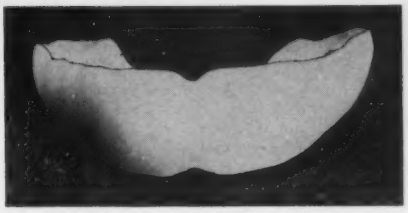

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